ARCHIVES OF OTOLOGY.

SUPPURATIONS IN THE LABYRINTH.

(*Concluded.*)

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5.—DIAGNOSIS.

LABYRINTHINE suppuration is easily diagnosed in cases where the typical symptoms, vertigo, deafness, nystagmus, nausea, and headache are well developed. The difficulty of proving unilateral deafness is known to be considerable, and the result of Weber's test is not always reliable. Another difficulty arises when the typical symptoms are present except deafness,—symptoms which may be due to a labyrinth suppuration confined to vestibule and semicircular canals or to a cerebellar abscess. The latter diagnosis would have to be supported by additional symptoms not found in uncomplicated otitis interna, as emaciation and prostration, mental changes, optic neuritis (in two thirds of all cases — Okada), slowness of pulse, etc. Cerebellar vertigo is more characterized by a staggering gait than by subjective dizziness, which difference, however, seems of little practical value. Extremely difficult is the diagnosis when labyrinth suppuration is combined with cerebellar abscess. As in the majority of cases the cerebellum is infected from the labyrinth, the combination of both affections is not uncommon. In one of our cases, which will be published elsewhere, the differentiation was impossible. In doubtful cases it is well to consider the fact that labyrinth suppuration is far more frequent

than cerebellar abscess. The presence of an abscess will become more probable if no improvement should follow the elimination of the labyrinthine process. On the other hand, if the presence of a cerebellar abscess should be established, the exclusion of other causative complications, as sinus-thrombosis, would lead to the additional diagnosis of a suppuration in the labyrinth.

The absence of characteristic symptoms may prevent even the suspicion of a labyrinth complication. A suspicious symptom would be complete deafness developing under our observation in a case of otorrhœa. Dizziness is too vague a symptom and too common in aural diseases; it is also found in intracranial complications not accompanied by labyrinth suppurations. Marked vertigo, however, is a suspicious symptom, and it becomes very valuable when combined with nystagmus. While nystagmus does occur independently from aural lesions, its character and anamnestic data will aid us to properly estimate its diagnostic value.

The labyrinth suppuration may be disguised by the more conspicuous symptoms of a concurring intracranial inflammation; sometimes its existence may be deduced from the appearance of consequential meningeal symptoms (meningitis serosa). The uncertainty of the diagnosis in such cases will make an exploratory operation necessary, and the anatomical conditions thus revealed will frequently lead the way to the seat of the inflammation. We shall have to search for fistulous perforations on promontory or semicircular canals. It may be mentioned here that small cells on the prominence of the horizontal canal may resemble fistulous openings (*cf.* our Case 22), and also, that it may be difficult to say whether a fistula leads into the facial or into the semicircular canal. The region of the oval window has to be carefully examined. If it should be covered with granulations, a positive statement as to the condition of the stapes may be impossible.

In operations for extradural and cerebellar abscess, a search has to be made for communications existing between the abscess and the labyrinth. The seat of the perforation may point to the extension of the suppuration,— infection through

the promontory or the oval window usually involving the whole labyrinth, infection through a fistula of the horizontal canal frequently remaining localized to the canal affected or to the vestibular cavities.

6.—PROGNOSIS AND TREATMENT.

From what has been said before, it is evident that we can never predict with certainty what course a suppuration of the labyrinth will take and how it will terminate. Spontaneous healing is not impossible; the suppuration may cease after a sequester has been exfoliated, or it may go on indefinitely without ever extending to the meninges. On the other hand, cases are quite frequent where the suppuration of the labyrinth suddenly leads to dangerous consequences, either without any apparent cause or owing to an acute exacerbation or to traumatic irritation. Inasmuch as we are unable to distinguish between favorable and dangerous forms, it would seem necessary to regard every suppuration of the labyrinth as a dangerous process, for the elimination of which we should use every possible means. Most important is the radical elimination of the destructive process in the middle ear, at the same time exposing and draining, if possible, the pathway of the infection into the labyrinth. In many cases this procedure will check and cure the inflammation in the labyrinth. In other cases the result of the operation may seem to be favorable, the wound healing up promptly; but the suppuration of the labyrinth may continue, and sooner or later meningitis may set in. Quite a number of cases have been reported where the mastoid operation was directly responsible for the extension of the infection into the cranial cavity.

It is a fact then that the effect of mastoid operations on suppurations of the labyrinth is rather doubtful; the realization of this fact has led to experiments tending to eliminate the process in the labyrinth itself, or to at least insure sufficient drainage of the affected cavities.

Jansen has first recommended and, to a certain extent, developed the operative treatment of labyrinth suppurations. In his article on "Deep Extradural Abscesses" (13),

published in 1893, he advised to "open the vestibule in labyrinth suppurations accompanied by meningeal irritation." Five years later (11) he reported his observations in 10 cases of operations on the labyrinth. In 6 cases the vestibule was curetted through the oval window, or fistulæ on the semicircular canals were laid open and enlarged. In one case, where the horizontal canal and the roof of the vestibule had "been destroyed by cholesteatoma," the rest of the vestibule and the cochlea were opened up. No untoward results followed in any of these 7 cases. In 2 cases the vestibule was opened by "removing with the chisel part of the horizontal canal." One of the patients committed suicide before the labyrinth suppuration was cured; in the second case, meningitis followed the curetting of the vestibule, which was done eight days after the operation. In one case of extradural abscess, which had perforated the superior semicircular canal, the canal itself and the vestibule were opened from behind, the latter, however, "insufficiently." The symptoms disappeared promptly, but after four weeks meningitis set in, which terminated fatally. It was caused by the suppuration in the vestibule. Jansen reported two more cases of labyrinth operations in 1898 (24). In one case the vestibule was opened first, and later also the cochlea, which discharged pus, because the symptoms of meningeal irritation continued; in the second case only the vestibule was freely opened. Both patients recovered. Stacke (51) reports a case where he opened the labyrinth through the promontory, and makes a plea for operations on the diseased labyrinth. Other operations were reported by Manasse and Wintermantel (52) and Grunert (53). The records of 2 cases of the Rostock clinic were placed at my disposal by Professor Koerner:

Case 1.—Mrs. K., age forty, admitted December 4, 1899. O. m. p. c., A. D. Discharge had ceased for years until it started again about a year ago. For two weeks, pain in right ear and frontal headache; for two days, tinnitus and severe vertigo, with nausea. No vomiting.

Status.—Patient very pale, unable to walk, has sensation of falling toward the right. Temp. 99.0° F.

R. ear: Defect of membrane; tympanum filled with granulations; little pus. Weber lateralized toward left ear. Nystagmus (rotary-like movements).

Dec. 5th, Radical operation.—Mastoid sclerosed; discolored granulations in antrum. Fistula in anterior crus of horizontal canal is enlarged, first upward to the dura, then forward. The exposed cavity (ampulla?) contains granulations and is curetted. Wound left open. Nausea and nystagmus disappear promptly, vertigo gradually. On the eighth day, sudden rise of temperature to 100.6°, with nausea and occipital headache; then undisturbed recovery. March 24th, cavity epidermized.

CASE 2.—Fr. H., age twenty-five, admitted October 30, 1899. Recurrent otorrhœa and pain in right ear. Four days ago sudden vertigo and vomiting.

Status.—Patient well nourished, very pale, weak, not able to stand up or to walk; falls toward right. Subjective dizziness, vomiting, earache. Temp. 98.8°, P. 78. L. ear, normal; R. ear, large perforation; no granulations or cholesteatoma in tympanum, but some offensive pus. Weber toward left. No nystagmus. October 31st: Restless night; discharge thin, sanguinolent.

Radical operation.—Mastoid sclerosed. Cholesteatomatous matter in antrum, attic, atrium, and tubal orifice. Fistula above horizontal canal leads into small carious cavity, filled with granulations, and apparently communicating with vestibule. The cavity is laid open and curetted. Wound left open.

Nov. 1st.—Vertigo diminished. November 4th: Slight facial paresis. November 9th: Paresis little marked. November 17th: Closure of retroauricular wound. January 8, 1900: Facial paresis has disappeared. January 28th: wound epidermized. Function: Wh. 0 — 20 *cm.* (according to different numbers).

In another case from Koerner's clinic reported by Muck (54), an empyema of the endolymphatic sac was evacuated without opening the labyrinth, the sacculus having been infected directly from the diseased bone. Patient recovered.

The records of the Breslau Polyclinic (Professor Kümmel) contain the observations on a number of suppurations of the labyrinth, where the latter was opened intentionally.

CASE 13.—P. B., age thirteen. O. m. p. c., A. S., for three years after measles. Swelling behind the ear began two weeks ago.

Status.—Discharge of greenish pus; left canal filled with granulations; deafness; subperiosteal abscess.

Radical operation, June 20, 1898.— Large cholesteatoma. Sequestrum on promontory. After its removal, cochlea and vestibule are wide open. Fistula seems to lead into horizontal canal. Labyrinth is curetted; curette seems to reach the porus acust. int.; its withdrawal is followed by hemorrhage and free discharge of cerebro-spinal fluid. Complete facial paralysis. Liquor continues to flow for five days. Undisturbed recovery.

CASE 14. — E. D., age seventeen. O. m. p. c., A. D. Pain and dizziness for five weeks. When head is bent strongly forward or backward, patient falls forward toward left side. Closing of eyes does not increase vertigo. Nystagmus in extreme abduction and convergence of eyes. Right facial paresis. Deafness.

Sept. 4, 1897, *Radical operation.* — Granulations and pus in antrum. Fistula in posterior crus of horizontal canal; vestibule is easily opened, its lateral wall being partly necrosed. The opening is enlarged underneath the facial to the oval window. Recovery.

CASE 15. — R. M., age nineteen. O. m. p. c., A. U., for five years; lately dizzy when stooping.

Left ear: Large polyp in meatus, profuse discharge. Mastoid tender. Right ear: fetid discharge.

Aug. 26, 1899. — *Radical operation* on left ear. Large cholesteatoma. No complication. Primary suture.

Aug. 28th. — Suture infected; stitches are removed. After a few days facial paresis appears. Abundant granulations are cauterized with chromic acid.

Oct. 1st. — After cauterization sudden rise of temperature, severe earache, pain on pressure along jugular vein. Symptoms disappear with rest in bed.

Oct. 31st. — After use of probe severe attack of vertigo with nystagmus. Temperature to 100.8° on same day.

Second operation.—After removal of flabby granulations a fistula is seen on horizontal canal. Following its anterior crus the vestibule is opened. Granulations in both cavities. Cochlea is opened through promontory. Inferior convolution contains granulations. Curettement: Temperature normal after operation, nystagmus disappears promptly, vertigo marked for ten more days then subsided gradually. Recovery.

CASE 16. — B. M., age sixteen. O. m. p. c., A. U. Frequently

dizzy during last few years; for five days severe vertigo, which makes walking difficult; headache.

Oct., 1899, *Status.* — Right ear, total defect of membrane, promontory partly covered with granulations, partly denuded. Deafness: Left ear, canal stenosed, fetid discharge. Conversation voice: 1.5 *m:* nystagmus when looking toward left.

Radical operation on right ear.—Granulations in antrum. Small fistula in horizontal canal. Canal and vestibule are opened, both contain granulations. Cochlea is opened through promontory and the opening enlarged to the oval window. The facial canal remains as a delicate osseous bridge. No discharge of cerebro-spinal fluid. Vertigo increased after operation. On the second day nearly total deafness of *left* ear; hearing function returns after a few days. Nystagmus disappears quickly, dizziness gradually. Recovery. Right ear remains deaf, left ear hears conversation voice for 2 *m.*

Case 17.—W. T., age forty-two, with pulmonary tuberculosis, O. m. p. c., A. D., for six years. Discharge increased six weeks ago. Some time later sudden dizziness and vomiting.

Status, Nov. 27, 1900. — Patient fairly well nourished; gait staggering; vertigo increased when eyes are closed; no distinct nystagmus. Right ear: large perforation in lower part, fistulous opening in upper part of membrane; deafness. Temperature 99.3°. Pulse 100. Left ear normal.

Radical operation. — Large cholesteatoma. Sinus exposed. Facial canal eroded. Fistula in horizontal canal is enlarged with burr, vestibule opened from the posterior crus. No cerebro-spinal liquid escapes. Sinus accidentally injured with burr. Undisturbed recovery. Subjective dizziness disappears after two days, objective vertigo after many weeks.

Case 18.—P. K., age fifteen. Chronic otorrhœa; no labyrinth symptoms; ear deaf; mastoid fistula.

Radical operation. — Cholesteatoma has eroded the horizontal semicircular canal; fistula is enlarged; posterior crus followed up into vestibule. Free discharge of cerebro-spinal fluid. After the operation severe vertigo for a week, then slowly subsiding. Recovery.

Case 19. — E. K., age nineteen (extensive report will follow). O. m. p. c., A. D., for about four years, with occasional dizziness. No objective vertigo, no nystagmus. Function: wh. for 50 *cm.*

Oct. 1, 1900, *Radical operation.*—Mastoid sclerosed. Antrum

small. No complication. Patient complains of severe dizziness; vomiting.

Oct. 6th. — Slight twitching on right side of face. Vertigo; nystagmus when eyes are turned toward left. During the following days, the symptoms of beginning meningitis appear. Rigidity of neck, fever, restlessness, irregular pulse. October 9th, fever.

Second operation is performed with the intention of eliminating the suppuration in the labyrinth. Manipulations difficult on account of abnormal position of sinus. Efforts to open the labyrinth from behind fail. Only posterior canal is opened; escape of liquor. No improvement. Death October 15th.

Autopsy.—Extensive meningitis; probable pathway of infection along sinus caroticus to cavernous sinus. Labyrinth infected through oval window; stapes dislocated inward, annular ligament destroyed, foot-plates intact. Exudation and infiltration in cochlea, vestibule, and canals.

Case 20. — E. G., age thirteen. O. m. p. c., A. S., lately dizziness. March 26, 1901: Pus in left ear-canal. Remnant of membrane with hammer. No nystagmus, no objective vertigo. Ear nearly deaf. March 28th: Incision of small furuncle in front of tragus. Patient does not call for several days, because of dizziness, headache, and fever. On April 2d his gait is somewhat staggering; complains of severe dizziness. Admitted for observation. Symptoms disappear during rest in bed. April 5th: Patient feels perfectly well and asks to be discharged. Suddenly after dinner (noon) severe headache sets in and vertigo; evening temp. 104.0°; drowsiness, slight rigidity of neck. Immediate *radical op.:* Mastoid sclerosed. Antrum large, contains pus. Oval window open, stapes missing. All symptoms improved temporarily. On April 7th another rise to 104.0°, and increased vertigo. Immediate *operation* on *labyrinth:* Vestibule opened with burr from ant. crus of horiz. canal. Cochlea opened from oval window. No discharge of cerebro-spinal fluid. Cochlea contains turbid serum; temporary improvement of subjective symptoms. Death from meningitis April 11th.

Autopsy.—Basilar meningitis; left acoustic nerve enveloped in pus. Micr. exam.—Facial nerve intact; vestibule empty; exudation and infiltration in cochlea; similar changes in semicircular canals. Round-cell infiltration of acoustic nerve and its branches.

In the following two cases the healthy labyrinth was opened on account of a diagnostic error:

CASE 21.— F. G., age sixty-three. Protracted acute suppuration of right middle ear. July 16, 1900: The antrum is opened and a *radical* operation performed on account of the extensive destruction. No complications. There were no labyrinth symptoms before the operation. The ear was rather deaf. On fifth day after the operation sudden rise of temp. to 104.4°, with severe dizziness, stupor, headache. Exploration of wound in narcosis; middle and posterior cranial fossæ opened. The result is negative and leads to the diagnosis — labyrinth suppuration. Vestibule opened from posterior crus of horiz. canal. No escape of cerebro-spinal liquid. Immediately after the operation severe dizziness and vertigo at the slightest movement. Temp. remains high. Two days later erysipelas appears on the face. Convalescence protracted by relapses of erysipelas, perichondritis of auricle, and extensive necrosis of corticalis. Recovery.

CASE 22.— C. K., age thirty-one. O. m. p. c., A. S., for four years. Radical operation proposed two years ago but refused. Discharge ceased for some time but reappeared six weeks ago, followed by headache, dizziness, fever, general weakness.

Status, April 27, 1901.—Left ear deaf. No nystagmus; fundus of eye normal; temp. 99.5°. Immediate *operation:* Large cholesteatoma in mastoid and antrum. Sinus exposed and covered with granulations. Apparent fistula on horiz. canal. As a labyrinth suppuration was probable, an effort was made to open the vestibule by following the fistula and the posterior crus of the horiz. canal. The effort is unsuccessful. Then the stapes is removed and the oval window enlarged with burr. Discharge of cerebro-spinal fluid. Severe vertigo after the operation. Further developments showed the case to be one of sinus-phlebitis. Patient died from pulmonary abscesses in spite of operation on the sinus with ligation of jugular vein. No meningitis. Microscopic examination later.

The number of operations on the labyrinth of which I was able to find a report is thirty-one and the *results* were the following:

The termination is not mentioned in 2 cases (one of Manasse's, one of Stacke's); 23 cases recovered, 6 died; of Jansen's cases one died from meningitis four weeks after the labyrinth operation; in one case meningitis followed the

curetting of the vestibule, which was done eight days after the operation, and one patient died from suicide before the labyrinth suppuration was cured. Two of our cases died from "labyrinthine" meningitis, which had apparently set in before the operation on the labyrinth; one died from meningitis which was not due to labyrinth suppuration. The cases which recovered showed no ill effects from the operation.

The question arises, whether the meningitis in the cases that died was caused by the operation on the labyrinth or not?

In one of Jansen's cases the curetting of the vestibule seems to have at least accelerated the fatal termination. In the second case, where meningitis set in after four weeks, the result of the operation itself was favorable, although insufficient to permanently check the labyrinth suppuration. In the case of the suicide, the opening of the vestibule had also a favorable effect, although the labyrinthine suppuration was still marked at the autopsy, several months later.

The *value* of an *operation* is largely dependent on (1) the amount of danger involved; and (2) on the benefits derived from it.

While our experience with operations on the labyrinth is far too limited to determine their practical value, the results heretofore obtained are rather encouraging. In only one of the reported cases (1 in 29 = 3–4 %) the result was unfavorable, and even in that case it is possible that the radical operation was responsible, and not the opening and curetting of the labyrinth.

The danger involved seems to be chiefly due to the concussion from chiselling and to the tearing of protective adhesions; there is no doubt that the danger will be considerably reduced by technical improvements. The beneficial effects, on the other hand, have been very striking, 21 out of 27 cases having been cured. Of the 6 fatal cases, in 2 the cause of death was independent from the labyrinth suppuration, and in 2 cases meningitis was present before the operation in the labyrinth.

That leaves 2 cases that died, and 21 that recovered —

a mortality of about 10%. It seems reasonable to presume that the mortality would have been higher in these 23 cases, if the labyrinth had not been opened. Jansen reports a mortality of 10% in his cases of labyrinth suppuration; but by far the larger number were cases of isolated affections of the semicircular canals, which offer a comparatively good prognosis, and do not, as a rule, require a labyrinth operation. The mortality of more extensive infections of the labyrinth is decidedly higher. Bezold estimated it at from 16 to 20% for the chronic cases with necrosis, and of the acute cases observed by Scheibe (28) 3 out of 4 died, or 75%. This tends to show that the high mortality of labyrinth suppurations should and can be reduced by direct operative measures. The results are more doubtful, but not at all discouraging, in cases already complicated with circumscribed meningeal infection. Jansen succeeded in "saving two cases where purulent meningitis was proved to be present (by lumbar puncture), and several others, where the clinical symptoms of meningitis were marked." The only chance of averting the fatal termination in such cases seems to depend on the thorough elimination of the primary suppuration in the middle ear *and* in the labyrinth. The *indications* for operations on the labyrinth have been formulated by Jansen (11), as follows:

1. Opening of the vestibule is *allowed* in all cases with *severe* labyrinth symptoms; it is *necessary* where the conditions found in the middle ear (in radical operation) do not sufficiently account for those severe symptoms (pressure against stapes or fistula in semicircular canal by cholesteatoma, granulations, sequestrum, retention of pus).

2. In cases with less severe labyrinth symptoms, but with labyrinth fistula, where the suspected retention of pus is not found in or on the mastoid bone.

3. In cases with distinct labyrinth symptoms, where the presence of a cerebellar or large extradural abscess is probable.

4. In cases of fistula in semicircular canals with symptoms of meningeal irritation.

These indications are judicious and conservative, but they

do not seem to cover the whole ground. Jansen does not answer the question when the cochlea should be opened. He opened it in one case with meningeal irritation which did not subside after the vestibule had been opened. Stacke opened it in one case, and we did so in three cases. It seems to be a fact that the cochlea is involved in nearly all cases of labyrinth suppuration requiring an operation. If the cochlea should be intact at the time of the vestibular operation, it is more than probable that it will become infected, or that at least its function will be destroyed by the cicatricial process. For these reasons, I would suggest that in all cases which call for an operation on the vestibule the cochlea should also be opened, in order to insure proper drainage and to prevent further infection. Another point is the difficulty of determining the seriousness of a diagnosed labyrinthine affection. We have seen that cases of an apparently serious character may heal up spontaneously, and, on the other hand, that cases with not at all severe symptoms may suddenly develop meningitis, sometimes after mastoid operations or without any provocation. The "severity of symptoms" as required in Jansen's indications is not always present in severe and serious cases. Whether these indications should not be extended must be decided by further observations.

TECHNIQUE OF THE OPERATION.

Easily accessible is the horizontal semicircular canal; by following its anterior or posterior crus, the vestibule can be opened. The posterior canal and the posterior crus of the superior canal are reached from the posterior surface of the pyramid, and can also be followed into the vestibule. The latter is opened anteriorly through the oval window, which can be enlarged by removing its inferior border. Of the cochlea only the inferior convolution is accessible through the promontory. Access will be difficult in cases where the carotid canal protrudes far into the tympanum, as shown by Koerner (55) and Gruber (56). The rest of the cochlea is not accessible, except in cases where its bony framework is destroyed. Jansen (60) reports that in such

cases "it is easy to make a large opening below the facial and in front of the oval window, and to remove with burr and curette the contents of the cochlea, as pus, granulations, and carious particles. Injury to the carotid artery on the medial wall of the cochlea is surely avoidable. The fossa cribrosa should also be avoided." Which way we ought to choose for entering the labyrinth will depend on individual anatomical and pathological conditions. In cases complicated with extradural or cerebellar abscess, Jansen (57) recommends to expose both foci by "removing with narrow, straight chisel the posterior half or two thirds of the superior canal and, if necessary, part or all of the posterior canal; the vestibule is then opened from behind and the opening enlarged by removing the posterior crus of the horizontal canal." Under favorable conditions Jansen evacuated deep extradural abscesses through the median wall of the antrum and through the labyrinth. He recommends to enter the vestibule by way of the horizontal canal, behind the facial, and states that "little is gained by extraction of the stapes."

Examination of anatomical specimens shows that the vestibule may be reached either from the posterior or anterior crus of the horizontal canal, that posteriorly the wall is thicker than anteriorly, but that the anterior opening is in close proximity to the facial canal. The thinnest point of the vestibular wall is just above the oval window. In difficult cases the position of the vestibule can be ascertained by the introduction of a probe through the oval window, which is always easily located and easily invaded. It may be enlarged inferiorly to nearly twice its normal size, the vestibule thus being opened at its lowest point. The use of a suitable probe will aid us considerably in removing the rest of the vestibular wall above and behind the facial canal, which will remain as a thin bony bridge. The different steps of an operation on the labyrinth would be the following:

1. Radical operation. The posterior wall ("facial spur") is removed sufficiently to expose the region of the oval window.

2. Opening of foramen ovale and, if opening of cochlea is intended, removal of promontory.

3. Introduction of probe through oval window and, under its guidance, opening of the vestibule from the horizontal canal, if possible along its anterior crus, or, under difficult anatomical conditions, from behind.

The electric burr is preferable to the chisel, and a very fine burr should be used.

The use of the burr minimizes the injurious concussion; it facilitates the technique of the operation, and avoids the dropping of bony chips into the cavities of the labyrinth.

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A CASE OF PRIMARY ACUTE PURULENT INFLAMMATION OF THE MASTOID CELLS, INVOLVING NEITHER THE MIDDLE EAR NOR THE MASTOID ANTRUM.

By JOHN DUNN, M.D., Richmond, Va.

As a rule, both empyema and osteitis with softening and destruction of the mastoid cells and process walls, are either coexistent with or directly secondary to demonstrable purulent conditions of both mastoid antrum and the middle-ear cavity. Although it is rare, primary purulent mastoiditis, differing in no way from the secondary affection save in the absence of symptoms directly referable to the antrum and middle ear, does occur.

Mr. W., aged nineteen, was brought to me February 5, 1902. History as follows: Two weeks previously he had taken a cold which "affected first the left side of my throat and then the right. As soon as it got in the right side the bone back of my ear began to ache and then the whole side of my head, and I have suffered terribly ever since." There had never been, so far as the patient knew, any previous ear trouble. Condition February 5th: Hearing for watch on the left side normal; on the right side four feet. Mucous membrane of nose, naso-pharynx, and pharynx normal. No excessive secretion. Drum membrane of the right ear showed no sign of inflammation, no reddening of the skin adjacent to or over Schrapnell's membrane, or over lower part of drum. The drum appeared abnormally pale, of a dead white color. The malleus handle could be seen only for its upper half; the lower half seemed buried out of sight in the dead white of the drum. Temperature 99½° F. Pulse 68 and irregular. The patient complained of great pain in the right side of his head. The pain

was not confined to any one region. The mastoid was sensitive to pressure over its whole surface, especially over its posterior half and over the mastoid fossa. It was also painful for the patient to turn his head to the left — *i. e.*, to put the right sterno-mastoid on the stretch. There was no swelling over the mastoid. The diagnosis of mastoiditis was made and an immediate operation was advised. For reasons unnecessary to mention here, the operation was deferred until February 11th. On the morning of February 6th the drum membrane, whose appearance was the same as it had been the afternoon before, was widely opened. There followed no discharge from the middle ear (the incision bled freely for a few moments), nor did any discharge come from the middle ear during the succeeding days. The patient was put to bed and kept there three or four days, during which there was none of the old pain in the temporal region, no spontaneous pain in the mastoid save for half an hour or so once or twice. The patient's pulse continued slow and markedly irregular both in its character and in the number of beats per minute, intermitting irregularly and at short intervals. The mastoid continued sensitive under pressure, in places exceedingly so. The patient's temperature remained nearly continuously slightly above normal. His tongue, which on February 6th was normal, began to show stronger and stronger evidences of infection; his breath became offensive. There appeared, however, no swelling over the mastoid. The pain produced by stretching the right sterno-mastoid continued.

On February 11th **the mastoid was opened** and was found to be filled with pus, granulations, etc., with softened bone. The antrum, situated deep, was found healthy, so far as I could judge. It contained no pus. All of the patient's bad symptoms disappeared with the operation and the mastoid wound rapidly healed. That the Eustachian tube was patent was shown by the fact that for two or three days after the operation the patient's sputum was stained with blood.

The case is interesting as showing that the mastoid cells may become the seat of purulent osteitis with softening without the existence of a purulent condition of either the middle ear or antrum.

The infectious agent, probably that of the grippe, which had caused the transient sore throat, found its way into the Eustachian tube, into the middle ear, into the mastoid an-

trum, and thence into the cells, and found only in these latter, for some unknown reason, the resistance so much weakened that it was possible to cause a purulent inflammation resulting in osteitis of the cell walls. The peculiar appearance of the drum membrane was probably caused by inflammation in early childhood of which the patient had no recollection. It is not unlikely that at the same time the vitality of the mastoid was weakened, making thus a purulent inflammation possible without similar trouble in the antrum or middle ear. Dr. H. Knapp in his review of *Thérapeutique des Maladies de l'Oreille*, Lermoyez and Boulay, ARCH. OF OTOLOGY, vol. xxxi., p. 83, says: "Primary mastoiditis from influenza, etc., may occur, but is exceptional. The cases considered and described as primary mastoiditis are mostly such as originated in the naso-pharynx as usual, and affected the drum cavity lightly, but freely developed in the mastoid process."

A CONTRIBUTION TO THE PATHOLOGY AND DIAGNOSIS OF TUBERCULOUS OTITIS MEDIA.

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(From the Laboratory of the Royal College of Physicians, Edinburgh.)

(*With Text-plate I.*)

CASES of suppurative otitis media, with possible, yet doubtful, tuberculous complication, were so frequently met with at the Royal Infirmary, Edinburgh, that it was obvious such cases offered an important field for observation, both with a view to determining a clearer clinical picture for distinguishing the tuberculous from the non-tuberculous, and also of ascertaining what methods of pathological and bacteriological investigation can be held to establish an indisputable diagnosis during life.

The following appeared to me to be the chief points to be investigated and studied in the endeavor to elucidate this question.

1. What light is thrown on the nature of the otitis by such symptoms as: the presence or absence of pain; bare bone felt through the external auditory meatus; destruction of bone about the middle ear; facial paralysis; perforation of the inner wall of the mastoid process (Bezold's perforation); enlarged glands over the mastoid process and in the neck; abscesses and sinuses in the same situations, and polypi in the external meatus?

2. What proportion of cases of suppurative otitis media, with bone lesion, are tuberculous (*a*) in children, (*b*) in adults; and at what age is the tuberculous form most frequent?

3. Do the naked eye and microscopic appearances of the pus, granulations, and diseased mucous membrane, from the middle ear (where such can be safely removed) afford any reliable evidence; and also, what information is to be derived from a similar investigation of naso-pharyngeal adenoids; of an enlarged mastoid gland, or other enlarged glands from near the diseased ear?

4. From what source and by what channel does the bacillus tuberculosis reach the tympanum, and what light is thrown on this point by microscopic examination — post-mortem — of sections of the Eustachian tube, the tympanic membrane (when sufficient has escaped destruction to permit of examination) and other neighboring parts?

5. What relation exists between tuberculous naso-pharyngeal adenoids and tuberculosis of the middle ear?

6. Is tuberculosis of the middle ear a primary or a secondary infection, or may it be either?

7. Does the discovery of tuberculosis in other organs give any reliable indication as to the nature of the ear disease?

8. How far may inoculation experiments on guinea-pigs, with products of the diseased middle ear, assist in the diagnosis of tuberculosis?

Lastly, I have studied the best methods of preparing, mounting, and staining microscopic specimens.

In considering the literature of tuberculosis of the middle ear, an endeavor has been made to give the present state of our knowledge — fully, yet briefly.

Von Tröltsch first pointed out that tuberculosis frequently occurred in the course of chronic otorrhœa, although the frequency with which chronic otorrhœa occurred in persons suffering from phthisis had been previously observed by several authors, *e. g.*, Romer, Grisolle, Nelaton, and others.

Only since the discovery of the bacillus tuberculosis by Koch, in 1882, has the pathology of this disease made any marked advance.

The first to demonstrate the tubercle bacillus in aural discharge was Eschle, in November, 1883. McBride and Gruber

Illustrating Dr. Grimmer's Paper on Tuberculosis of the Middle Ear.

Fig. 1.—Tubercle bacilli, single, in V-shaped arrangement, and in clusters. From a section of naso-pharyngeal *adenoids*. Stained with carbol-fuchsin and discolored, but not counterstained. Photographed, $\frac{1}{18}$ oil immersion; no eye-piece.

Fig. 2.—Tubercle bacilli from a *caseous patch of the mucous membrane of the tympanum*. $\frac{1}{18}$ oil immersion; no eye-piece.

Fig. 3.—Four giant cells; from section of *mastoid gland*. Stained with carbol-fuchsin, counterstained with methyl blue. $\frac{1}{6}$ lens; no eye-piece.

Fig. 4.—Giant cell, with nuclei around its periphery and one tubercle bacillus in the right upper corner of cell; from section of *mastoid gland*. Stained with carbol-fuchsin and methyl blue. $\frac{1}{18}$ oil immersion; without an eye-piece.

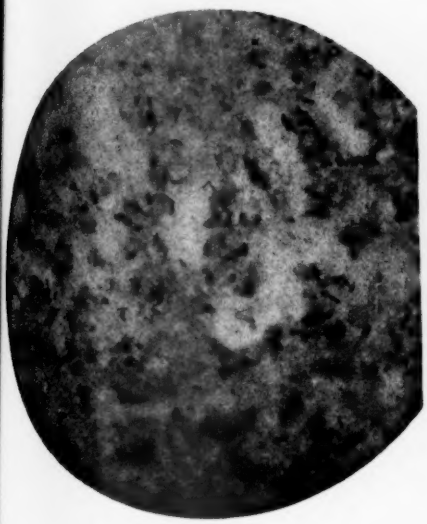

FIG. 1.

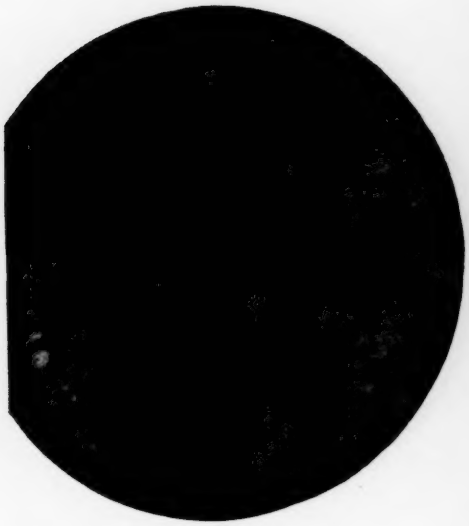

FIG. 2.

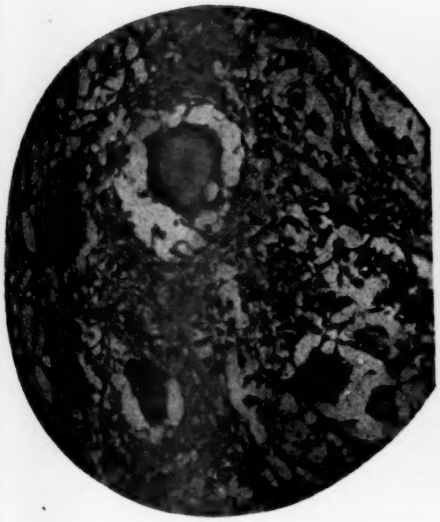

FIG. 3.

FIG. 4.

give to Voltolini the credit of this discovery, but give no dates; while Habermann would seem to have been first to demonstrate giant cells and tubercle bacilli in the mucous membrane of the middle ear in certain cases of phthisis (McBride).

The bacilli find their way into the tympanum in one of three ways: (1) by the Eustachian tube, mechanically, or by extension along its wall; (2) by the blood or lymphatic vessels; (3) through a previous perforation of the tympanic membrane. Milligan's statistics prove that this disease is frequent in children, and Brieger's, that there are more cases than clinical observations bring out. Brieger found that twenty-five per cent. of post-mortem cases, with tuberculosis, showed involvement of the ear, while Politzer, Scheibe, and Winkler maintain that the disease is most frequent in persons suffering from tuberculosis in other organs.

Among the chief predisposing causes which are mentioned by various authors are: phthisis; lupus and tuberculosis of the nose and other organs; hereditary tendency; unhealthy environment; unsuitable feeding; tuberculous relatives; and, in infants, tuberculous naso-pharyngeal adenoids; while as a cause Ostmann lays special stress upon the disappearance of fat from the lateral wall of the Eustachian tube in wasting disease, by making this tube more patent. Childhood is looked upon as a predisposing cause, since the Eustachian tube in children is shorter, straighter, and more patent than in the adult.

Tuberculosis of the ear may be a primary or secondary affection, most frequently the latter. There are differences of opinion as to the site at which the disease generally begins in the tympanum. Habermann, Winkler, and Brieger hold that it commences on the mucous membrane of the tympanum, especially near the promontory; Kuester, in the antrum; while Bernstein states that the membrana tympani may be first affected.

Tuberculosis of the ear may be acute or chronic. In the acute variety (which, Brieger says, is really tuberculosis plus mixed affection) there is a diffuse, cellular infiltration of the mucous membrane, with proliferation of the cells; giant

cells are absent, but bacilli are numerous. The result is a rapid caseous disintegration of the mucous membrane. The bone is soon involved, and great destruction of it takes place, frequently with the formation of sequestra; while rapid granulation formation is also a feature of the acute variety. In the chronic form, circumscribed masses of miliary tubercle may be first seen on the superficial portion of the mucous membrane of the tympanum; these caseate, giant cells develop, bacilli are few, and the process gradually spreads deeper by ulceration. The spread of the process may be stayed, however, by fibrous-tissue formation cutting off its advance; but in most cases the bone becomes involved in a cario-necrosis, the disease finding its way into the labyrinth or mastoid process. Spread of this disease to the brain membranes is not very common, except in children, owing to fibrous-tissue formation closing the lymph spaces (Brieger).

Moos (S.), in his study of the pathology of chronic purulent myringitis in tuberculous individuals, found irregular hyperplasia in the Malpighian layer towards the cuticular layer. In the cuticular layer, the normal blood-vessels were enlarged; there were numerous new vessels and round cells, and new connective tissue; while in the mucous membrane of the membrana tympani there was hyperplasia, caused by the inflammation. In the substantia propria, he never found true vascular inflammation. In the handle of the malleus, he found carious processes on the outer surface, and increased thickening of the periosteum on the inner side.

Schwartze described small gray miliary tubercles on the inner wall of the tympanic cavity in children, the subject of tubercle, with purulent otitis, and visible as gray cheesy deposits.

"Tuberculosis of the middle ear is characterized by the long latency of its process and the absence of pain" (Brieger). Hartmann describes this disease as arising without definite symptoms. Politzer says: "In the majority of cases its presence is known by the subjective disturbances of hearing, and a slight discharge." With reference to the effect on hearing during the early stages, authorities differ.

Hartmann says there is impairment, while Dench claims that no impairment is noticeable. Moldenhauer only found impairment of hearing in 2.4 % of phthisical persons, while Brieger proved that 25 % of persons dying of phthisis show evidence of tuberculosis in the organs of hearing. Winkler considers the loss of hearing in one ear, bone-conduction remaining good, would point to tuberculous involvement in a tuberculous patient. He also says that in the later stages the disease has no distinctive symptoms to show, because it is then a mixed infection; Buck's opinion on this point is much the same.

Hovel says tubercles may be seen in the tympanic membrane before perforation, appearing as gray or minute reddish spots, and that when these break down perforations appear, perhaps several in number; the disease thus tends to rapid destruction of the membrane.

Multiple perforation, in the drum membrane, is a symptom recognized by all authorities as strongly pointing to a tuberculous origin.

Dench describes a tubercular perforation as follows: "It is usually circular, the edges thick and everted, and present, instead of the bright red color commonly observed in a simple perforation, a blue-white glossy œdematous appearance." Milligan describes the edges of these perforations as pale and indolent-looking.

Tuberculous ear discharge is described by Milligan as thin, profuse, purulent, and fœtid; by Winkler, as creamy, profuse, and at times blood-stained in the early stages; after mixed infection occurs, its character changes. The granulations are described by Milligan as flabby; by others, as pale and œdematous, frequently large, and filling the whole mastoid process, which has been hollowed out by them. There is frequently destruction of the mucous membrane of the tympanum and antrum, leaving the underlying bone bare, which can be felt with a probe (Politzer, Brieger).

Politzer says examination shows in recent cases a creamy secretion, a pale membrana tympani softened and perforated in the central portion or at the extreme periphery. Hartmann considers the lower half of the drum the typical place

for these perforations to occur, while Buck thinks the upper posterior quadrant the most typical situation.

Roosa considers hemorrhage from the ear a frequent symptom in tuberculous suppuration of the middle ear.

Destruction of bone, often without external manifestation, is an important symptom, and this is often early and very extensive; consequently, facial paralysis is very liable to occur in this disease as an early symptom, owing to destruction of the wall of the Fallopian canal, while it is extremely rare in the early stages in non-tuberculous disease, owing to the bone not being early involved in this type of case.

In consequence of the hollowing out of the mastoid by tuberculous granulations, its cortical layer frequently gives way, causing an abscess to form behind the ear, which may burst and leave a sinus.

Haenel, who studied cases which had secondarily involved the inner ear, states that he only found six recorded cases up to 1896; while Brieger, in his paper (1899), says he has reported seven cases, and believes this complication is frequent.

The importance of finding tubercle bacilli in aural discharge is viewed differently by investigators. Many of them take this as an absolute proof of the existence of tuberculous changes in the ear. Gruber, Politzer, and Bernstein do not admit this, and Gottstein considers failure to find the tubercle bacillus in the ear discharge of small diagnostic importance, and quotes König and Marchand in support of this view; all are, however, agreed on the importance of searching for them in suspicious cases, and advise that the discharge for examination be taken direct from the tympanum. That it may be difficult or impossible to find the bacillus in an undoubted case is also a point agreed on by authors. Brieger recommends taking a piece of granulation for microscopic examination if possible, and gives a warning not to be deceived by the smegma bacillus; Siebenmann and Milligan advise inoculation of guinea-pigs as the best means of proving their presence. Brieger does not think well of this method, and says one may have to be

satisfied with demonstrating characteristic tuberculous structure and degenerative processes in the tissues affected.

In making a diagnosis the majority of authorities agree that the following are the most important clinical indications: a painless onset of discharge from the ear; two or more perforations; the presence of pale œdematous granulations; a creamy pus discharge; facial paralysis coming on at a very early stage; while bare bone may be felt through the meatus. During an operation, the bone being found soft and cheesy and much destroyed by granulations is an important symptom. Before rupture of the membrane, tubercles may be seen on the drum, or, after rupture, on the tympanic wall. Notwithstanding the many guiding symptoms, cases occur in which a diagnosis from clinical symptoms is very difficult. Authorities agree that all cases of suppurative otitis in tuberculous persons are not always tuberculous. Percussion dulness over the mastoid is mentioned by Brieger as a symptom. Field thinks that where, in a case of suppurative middle-ear disease, in spite of free drainage, discharge continues, the disease may be looked upon as tuberculous; while Barr considers that caries of the mastoid associated with otorrhœa and enlarged glands in the neck, especially in children, indicates tuberculosis. In certain mild cases, Scheibe describes a thick, grayish, very adherent membrane, situated on the inner tympanic wall, as a positive indication of a tuberculous process.

The points in non-tuberculous otorrhœa which help to make a differential diagnosis are: that there is generally acute pain, associated with perforation of the tympanic membrane; that the inflammatory reaction is of a sthenic type; that there is much less destruction of bone, in the early stages at all events; that perforations are not pale and multiple, but red and single; that the internal ear is not so liable to become involved; and that facial paralysis early is very infrequent.

Scheibe asserts that otorrhœa associated with cholesteatoma is never tuberculous.

The prognosis, on the whole, is unfavorable, owing to the tendency of the disease to involve bone and to spread to

other organs, but especially so if the case is already complicated by tuberculosis in other organs—*i. e.*, lungs. If the disease involve the ear only, recovery may take place under suitable treatment. As to retaining the hearing power in the affected ear, the prognosis is unfavorable.

Dench recommends in primary cases early removal of the focus of the disease; McBride states he never met with a case in which he considered this treatment advisable, but when caries and necrosis of the bone have occurred, he advises a radical operation, if the patient's general condition permits.

Milligan divides cases for treatment into: (1) Non-operable cases; such are infants with marked debility and emaciation; with advanced facial paralysis; masses of enlarged glands, and fœtid blood-stained discharge. (2) Operable cases; in these the general condition of the patient is good, and the main object should be to secure free drainage, by scraping away all diseased bone, and even exposing the dura and walls of the lateral sinus if necessary, in order to remove every trace of diseased tissue; then an attempt should be made to secure granulation of the cavity formed from the bottom. Enlarged glands in the neck should also be removed, while good nursing, fresh air, liberal diet, and tonics are agreed by all authorities to form an essential part of the treatment.

Milligan further says that when the ear has been destroyed as an organ of hearing, the antrum, tympanum, and mastoid cells should be thrown into one cavity, and this view is that which is generally accepted by authorities. Broca and Barbon think there is little danger of general tuberculosis following upon an operation for tuberculous middle-ear disease, and they believe that such ear disease can be cured, even when the patient has tuberculosis in other organs.

CASES.

Case 1.—Tuberculous purulent otitis media, left facial paralysis.

M. W., female, age five months; admitted Children's Hospital, Edinburgh, 22d December, 1900.

History.—In good health until six weeks ago, when a yellow pus discharge from the left ear, a cough, and twisting of the face to the right were noticed. Which of the three symptoms appeared first the mother is unable to say; but it would seem that each appeared about the same time. Since turning ill, infant has been frequently feverish; appetite and general health have gradually got worse, and for a few days there has been occasional vomiting.

A swelling was noticed behind the left ear shortly after the discharge commenced.

Family history.—None of tubercle.

Present condition.—A thin, pale infant. The anterior fontanelle is wide and slightly depressed. There is complete left facial paralysis; from the left ear there is a copious discharge of pus, thick, creamy, and fœtid, with a little blood occasionally. On pressure over the mastoid, pus wells up through the external auditory meatus. The posterior auricular glands, as well as those along the sterno-mastoid muscle are slightly enlarged, varying in size from that of a pea to a bean; there is occasional cough and slight diarrhœa.

Dec. 24th.—Slight holding back of the head and commencing retraction; vomiting has ceased. Slight tonic contraction of the right facial muscles noticed.

Dec. 27th.—Retraction of the head continues; pupils normal. There is a swelling, with fluctuation, over the left mastoid. Discharge continues free. A view of the deeper portions of the meatus cannot be obtained, owing to the swelling of the meatal wall. The right tympanic membrane looks normal.

Operation, Dec. 27th.—With usual incision behind left ear, an enlarged gland first came into view. (This gland was kept for future microscopic examination.) On dividing the periosteum a large empty abscess cavity was found, and the whole mastoid process and the posterior wall of the meatus were denuded of periosteum, and there was direct communication between the abscess cavity and the external auditory meatus, through its posterior wall.

While scraping out a superficial abscess, bleeding was noticed from the nose and mouth, showing that there must have been a large perforation, or complete absence of the tympanic membrane, allowing free passage of blood down the Eustachian tube. The bone over the mastoid antrum was not perforated, but very thin and exceedingly soft (caseous). No pus was found in the

mastoid antrum; it was full of granulations. A very large cavity remained when the granulations and soft caseous bone had been scraped out. The ossicles came away with the granulations. The inner wall of the antrum and tympanum did not appear softened, feeling firm to probe touch. No sequestrum was found, and the dura was not exposed. The bridge of bone between the antrum and tympanum was very soft. The granulations were pale red and flabby, and showed numerous gray caseating points.

Some granulations and softened bone, from the antrum, were taken for inoculation experiments. Other granulations were placed in absolute alcohol for section cutting.

After-history.—The operation wound remained healthy and clean, and showed a feeble attempt at granulating. Without further symptoms of meningitis the infant gradually sank, and died on 10th January, two weeks after the operation. I made a post-mortem examination, of which the following is an epitomized report.

External inspection.—Emaciated female child. Operation wound behind the left ear shows only scant granulations. The occipital glands on the left side are enlarged to about the size of beans. The abdomen is tumid. The anterior fontanelle is wide and depressed.

Internal inspection.—The brain looked pale; but otherwise normal. The roof of the tegmen tympani on the left side was paler than that on the right. The pia mater at the base of the brain, in the circle of Willis, looked thickened; there were no visible tubercles along its vessels (a portion of it was removed for section cutting). A portion of the squamous, the whole of the mastoid, and the petrous portions of the temporal bones and the Eustachian tubes on each side were removed for minute examination. Some adenoid tissue from the naso-pharynx was also removed. The lateral ventricles were of normal size and contained no fluid. Cerebellum normal.

The abdomen showed marked tubercular peritonitis, with numerous nodules, and the lungs typical miliary tubercular infiltration.

Left temporal bone.—On removing the dura mater the tegmen tympani was found very thin, but not perforated. The operation cavity was covered with frail, pale granulations. On removing the soft parts the inner tympanic wall was found somewhat destroyed, but the inner ear was not invaded. About the antrum

the destruction of the bone was extensive. The bone surrounding the carotid canal was eroded, but the artery was not laid bare. The foot-plate of the stapes was present. The bony wall of the Eustachian tube had become involved. The outer wall of the Fallopian aqueduct was gone at the downward bend, and the facial nerve could not be found.

Right temporal bone.—Its tympanic membrane looked smooth and normal on the external surface. When the mastoid antrum and tympanum were laid open by the saw, the mucous membrane was found much thickened and studded with small elevated gray points, each about the size of a pin-head. Tubercles were also numerous on the inner wall of the tympanic membrane and on the mucous membrane of the Eustachian tube. The underlying bone was not much, if at all, involved in the disease. The thickened mucosa almost filled the cavities of the antrum and tympanum. No changes could be noted in the inner ear.

CASE 2.—**Tuberculous purulent otitis media — both ears.**

M. McI., female, age seven years six months. Admitted Children's Hospital, Edinburgh, Sept. 14, 1900.

Family history.—Highly tuberculous on father's side only.

Previous history.—Healthy at birth ; teething late, tenth month ; speaking also late, second year. She had pneumonia in her fourth year and has never had good health since.

Present illness.—The discharge from ears commenced about twelve months ago ; the hearing got suddenly bad about three weeks before the discharge commenced,— previously it was good. She complained of some intermittent pain about the time the hearing became impaired ; three days before the discharge appeared, pain became continuous and very distressing, entirely preventing sleep. Pain was not complained of after the onset of the discharge, which was at first thin, afterwards thick, yellow, and more offensive, and has been continuous since its commencement. The onset was simultaneous in both ears.

Since the primary pain there has been little or none until three weeks ago, when the ears again became painful.

Sept. 25th.—Right mastoid antrum was opened and scraped out, but the granulations were not kept for examination.

Oct. 3d.—There is a foul-smelling, thick, yellow discharge from the left ear. No swelling or redness behind this ear. The tympanic

membrane appears to be entirely gone, and bare bone can be felt through the meatus.

Operation on the left ear. — The usual incision was made and the mastoid exposed; no sinus or bare bone was found, but the bone covering the mastoid antrum was very thin — a mere shell. The granulations in the antrum could be seen shining through the bone and looked bluish. The antrum was found filled with granulations, but contained very little pus. The bone surrounding the granulations was soft and easily scraped away. (The granulations, which were large and rather pale, without visible caseous points, and scrapings of bone were taken for inoculation and microscopic examination.)

A point noticed in this case was the large size of the mastoid antrum, and the considerable distance it extended backwards without reaching the lateral sinus.

After-history. — Granulation in both ear wounds was slow, and that in the right temporal bone remained unhealthy, and required a second operation, Nov. 29th.

Jan. 30, 1901.—The left mastoid wound is now an open cavity; looked healthy, and nearly covered with epithelium. The right was still a granulating surface. I have not been able to follow the history further.

CASE 3.—**Tuberculous otitis media of the left ear, with left facial paralysis.**

A. H., female, æt. three. Admitted Royal Infirmary, Edinburgh, Oct. 18, 1900.

History.—When three months old, a discharge commenced from the left ear, apparently without pain.

Shortly after, the face was noticed to be twisted to the right side. Once or twice glandular abscesses have formed and been opened behind this ear and also at the back of the neck. Polypi are said to have been removed on two occasions. The right ear has occasionally discharged, but hearing has been good.

Family history.—Nothing to note.

Present condition. — There is a fœtid discharge from the left ear of thick yellow pus, and a sinus opening below this ear, the skin above it being undermined and of a strumous appearance. Bare bone is felt through the sinus, and the left external auditory meatus is found completely blocked with a sequestrum bathed in pus, and within half an inch of the surface.

Operation, Oct. 21st. — A cavity was found, containing a sequestrum, at the lower portion of the mastoid process. On removing the sequestrum with forceps, it was found to consist of one large piece, about the size of a hazel-nut, and several smaller pieces. The sinus was found leading to the cavity containing the sequestrum; after the sequestrum was removed, numerous granulations were found surrounding it and lining the cavity. The sequestra were dark red, as were the granulations sticking to them; but the granulations lining the cavity in which they were lying were paler red and rather flabby. The sequestra were at some points hard and firm, at others soft and cheesy. (The sequestra were taken for microscopic examination, and the granulations for inoculation. An enlarged gland, found over the mastoid, was also taken for examination.)

After-history. — The granulating process was slow and the wound required frequent stimulation.

Jan. 15th.—The facial paralysis remains unaltered; the wounds are still unhealed, but are showing signs of closing. Her general health has greatly improved since coming into hospital. There is now practically no discharge from the meatus.

CASE 4.—**Tuberculous otitis media of the left ear; with transient left facial paralysis.**

E. E. M., female, æt. five months. Admitted Private Home, Edinburgh, May 21, 1900.

History. — When ten weeks old, a bad smell from her left ear was noticed, but was never marked; there was facial paralysis for three weeks, which has entirely passed off.

Family history.—None of tubercle.

Present condition. — There is a thick, foul-smelling, abundant discharge from the left ear and a sinus behind it. Not much tenderness about the ear. Notwithstanding the presence of a sinus, distinct fluctuation is felt over the mastoid. In the neck, there are a few enlarged glands. In the right ear there is some impacted secretion. Syringing brought some cheesy material from the left ear, but the tympanic membrane could not be seen.

Operation, May 22d. — The usual incision opened an abscess cavity containing about one ounce of pus. The periosteum was stripped from the mastoid, but no sinus was found in it; there was, however, but a thin shell of bone over the mastoid antrum, which was filled with granulations and pus. The granulations

were rather dark red and not œdematous. The communication between the tympanum and the antrum was free. The ossicles were not removed. Granulations from the mastoid antrum were taken for inoculation.

After-history.—Made a good recovery.

CASE 5. — **Tuberculous otitis media of the right ear, with hollowing out of the mastoid and Bezold's perforation.**

D. P., male, aged eight months. Admitted Private Home, Edinburgh, May 22, 1900.

History. — The right ear has been discharging for four or five months; two large abscesses in the neck on the right side have burst and left sinuses.

Present condition. — There is a foul-smelling discharge of thick yellow pus from the middle ear, and there are several sinuses in the neck below the mastoid process, and over the sterno-mastoid muscle, evidently arising from suppurating glands. Several glands along the posterior border of the right sterno-mastoid and also the suboccipital glands on the same side are enlarged. Pressure when applied below the left ear or over the mastoid behind it causes pus to well up freely from the external meatus. There is a perforation on the anterior meatal wall at its lower part, and through this pus appears on applying pressure as before mentioned. Nothing more can be made out by examination of the meatus. There are a number of flabby œdematous granulations about the orifices of the sinuses, and the skin has a markedly strumous appearance. There is a perforation of the tympanic membrane on the left side.

Operation, May 23d. — These sinuses were cut into one, and on removing a very thin plate of bone the antrum was entered and found to be full of granulations and pus. The whole of the mastoid process seemed hollowed out by the granulations, and there was a perforation on its inner wall near the tip. The dura mater was exposed at the upper part of the cavity, the pulsations of the brain being distinctly communicated to the blood lying at this part.

The granulations were large, flabby, and rather pale; several of these were taken for inoculation; patient made good recovery.

CASE 6 — **Chronic suppurative otitis media of the right ear, with right facial paralysis.**

H. G., female, aged four years. Admitted Royal Infirmary, Edinburgh, Oct. 16, 1900.

History. — The right ear began to discharge two years ago, shortly after measles and scarlet fever. Twelve months ago she had what her father calls a shock; was unconscious for an hour or more, and when she regained consciousness it was noticed that her face was twisted to the left side. At this time considerable pain was complained of in the region of the ear, and a swelling appeared at the angle of the right jaw. The discharge has been continuous and free ever since, and the facial paralysis has remained unaltered. Patient was able to run about up to the day of admission to hospital.

Present condition. — There is well marked left facial paralysis, not quite total, and from the right ear a free discharge of fœtid yellow pus. On probing bare bone was felt.

Oct. 17th. — Since coming to hospital the temperature has ranged between 97° and 98.4°. Pulse varies, last night 100, this morning 144. The respiration 20 last night, 30 to-day. The patient is very restless, takes nourishment with great difficulty, and has vomited several times this morning, the vomit being a greenish mucus. She tends to be somewhat drowsy, but cries if moved. There is neither swelling nor tenderness in the right mastoid region.

Examination of the ear. — The right ear is full of very fœtid pus, which up till this morning has been coming away freely, but less so during the last hour or two. The probe touches bare bone in the midst of the pus and close to the orifice of the external meatus. Nothing beyond this can be seen, as the meatus is found blocked by a sequestrum which can be moved by a probe.

Operation, Oct. 17th. — The usual incision was made for exploring the mastoid antrum. The periosteum was removed, and a thin layer of bone taken from over the lower portion of the mastoid process. This portion of the process was found full of granulations and the sequestrum felt anteriorly. A portion of the posterior meatal wall was removed to expose the sequestrum more thoroughly. The cartilaginous portion of the meatus was then divided sufficiently to allow a free communication between the mastoid wound and the external meatus. The sequestrum was removed through the combined openings posteriorly. The cavity left was found lined with granulation tissue. The ossicles were not seen.

In removing the sequestrum it was broken into three pieces, the largest being of the size and shape of the terminal phalanx of the little finger. These were each of a firm bony consistence, but had a worm-eaten appearance, and presented a number of hard sharp edges. No cheesy or caseous bone was found in any part of them. The granulations around them were large and red, and showed no caseous points. Some granulations were taken for inoculation; the sequestrum was kept for examination, and cover-glass films made from bits of the granulations.

After-history, Oct. 18th. — The patient remains in much the same condition as before the operation; there is frequent vomiting. The temperature varies from 97° to normal; the pulse 150. The wound looked very dry; no reaction. Evening: temperature 100°; pulse 160; respiration 40.

Oct. 19th. — She is semi-conscious, lies with her arms stretched out and knees drawn up, not easily roused, but occasionally exhibits great restlessness. Has now developed diarrhœa, the motions being passed unconsciously. She bores her head into the pillow and keeps it retracted, but does not seem specially sensitive to movements of the head. Nothing can be detected in the lungs, but there is a slight cough; pulse, 160; temperature, 99°; respiration, 38. No sweating, no cyanosis, no muscular twitchings, no retraction of abdomen. There is occasional grinding of the teeth and a tendency to collapse.

Second operation, 4.30 P.M., *Oct. 19th.* — The symptoms pointing to brain complications, a trephine was applied to the skull about half an inch above the right external auditory meatus, but nothing was found. The dura was stitched up and the wound closed. She never regained consciousness and died the following morning.

The following is an epitome of the Pathologist's report:

Body well nourished; well developed child

Thorax.— Lungs somewhat congested, no pneumonia, no tubercles, other organs healthy.

Abdomen. — Peritoneum healthy, mesenteric glands enlarged. Liver and kidneys each of uniform pale color from anæmia and extensive fatty changes.

Brain. — No meningitis, vertical or basal; cerebral sinuses healthy; on section, the gray matter of the entire encephalon showed intense congestion, but no other lesion.

Naked-eye examination of right temporal bone. — After removing

the dura mater from the roof of the right tympanum, a perforation was found twice the size of a pin's head; this led directly into the cavity in which the sequestrum lay. The walls of the mastoid antrum were not involved in the destruction of bone, but practically the whole of the inner ear, cochlea, bony labyrinth, and semicircular canals had been separated in the sequestrum, and are easily made out in it.

CASE 7.—**Chronic suppurative otitis media of the left ear with left facial paralysis.**

A. R. (female), aged four years. Admitted to Royal Infirmary, Edinburgh, Nov. 1, 1900.

History. — Shortly after birth abscesses formed behind the left ear; these were opened and soon after similar abscesses formed in front of the ear. About the same time the left ear began to discharge, and the discharge has continued ever since. Facial paralysis was noticed soon after the discharge commenced, and has gradually increased in degree.

Family history. — None of tubercle.

Present condition. — There is complete left facial paralysis, a free, foul-smelling discharge of thick yellow pus from the left ear, and a suppurating sinus over the lower portion of the mastoid process on same side, with pouting, pale, pinkish, flabby granulations around it. Bare bone is felt within the sinus, and a large freely movable sequestrum in the external auditory meatus.

Operation, Nov. 4th. — The sequestrum was readily removed through the meatus and found to be about the size of the thumb nail, but rather thicker. The sequestrum was of hard consistence, uneven and rough on the surface, with no caseous points. After the sequestrum had been removed this cavity was found to be lined with granulations. When these had been removed, it became evident that the whole of the posterior meatal wall as well as the lower wall and a portion of the mastoid process were gone, the cavity communicating freely with both the mastoid wound and the external auditory meatus.

In the position of the anterior bony wall of the meatus, the parts felt soft, as if it had disappeared also. No caseous bone was discovered, and the granulations within the cavity were different from those, previously described, around the sinus, as they were darker in color and not so flabby and œdematous.

After-history. — Seven weeks after operation, the sinuses were healed and the operation wound nearly covered with epithelium.

CASE 8.—**Chronic suppurative otitis media, left facial paralysis.**

W. C. (male), aged thirty years. Admitted to Royal Infirmary, Edinburgh, April 28, 1900.

History. — For thirteen years the left ear has discharged. Four years ago it became worse than usual, and continued so for two years, when he came to the Infirmary for treatment. At this time he had a polypus removed; it returned and was again removed four weeks ago. During the last two years he has syringed and attended to his ear intermittently, and for the last month regularly. Two weeks ago he had some granulations in the left meatus cauterized, and soon after pain in the ear became much worse. On April 27th left facial paralysis was noticed; the ear pain was very intense, and localized to the mastoid region.

Operation, April 29th. — The usual mastoid incision was made. The cortical layer of bone over the antrum was found much sclerosed. In the antrum numerous dark-red granulations were found, but no pus; some of them were taken for inoculation. The posterior meatal wall was removed.

After-history. — Uneventful; the facial paralysis disappeared in a few days, and the wound closed by granulation in about three weeks.

CASE 9.—**Suppurative otitis media; probably tuberculous.**

A. T. (male), age seven years. Out-patient, Eye, Ear, and Throat Infirmary, Edinburgh.

History, March 15, 1900. — Has been suffering from phthisis for some months. Through the night, four days ago, a discharge commenced from the right ear, without pain.

Family history. — Tuberculous on his mother's side.

Present condition. — There is a thin, yellow, purulent discharge from the right ear. This, on being wiped away, revealed a pale, sodden-looking tympanic membrane, with a small perforation at the posterior inferior quadrant. The edges of the perforation are pale and swollen, but without evidence of acute inflammatory reaction. Pressure over the mastoid process causes slight pain; the tonsils are slightly enlarged. Some pus was taken on a sterile swab, from the deeper portion of the meatus, for inoculation.

CASE 10.—**Chronic suppurative otitis media, complicating pulmonary and laryngeal phthisis.**

R. H. (male), aged thirty-five years. An out-patient at Royal Infirmary, Edinburgh.

History. — Patient's history was not taken on his first visit, and as he did not return it could not be obtained.

Present condition, March 20, 1900.—Both ears show perforations fairly clean cut, the remaining tympanic membrane is white, and on the inner wall there is a gray deposit.

After syringing. — The membrane is seen to be somewhat thickened, and the deposit on the inner wall remained in both ears even after drying. Both perforations are much bigger than they appeared before syringing. The probe detects bare bone on the inner tympanic wall on both sides.

A scraping was taken from the right middle ear with a sharp spoon for inoculation purposes.

CASE II.—**Right suppurative otitis media, with acute mastoiditis.**

W. McK. (male), age thirty-nine years; brewery man. Admitted to Royal Infirmary, Edinburgh, March 20, 1900.

History. — Nine weeks ago the right ear commenced to discharge, without pain. The discharge is very profuse and of a pale yellow color; it does not appear to have been bad-smelling at the commencement, but soon became so. Eight days after the discharge appeared, severe pain commenced in the ear, but was easier at intervals, following a freer discharge. Two weeks ago the discharge became less, and a swelling appeared over the right mastoid process, extending to the temporal region. There has been a throbbing sensation in the ear almost from the first appearance of the discharge.

Of late years, cuts or scratches have healed badly, but patient says he has always enjoyed good health, excepting fifteen years ago when he had pneumonia.

Family history. — Tuberculosis on his mother's side.

Present condition. — Patient looks flabby and unhealthy. There is an acute inflammatory condition in the right mastoid region, extending above the level of the auricle, fluctuating at the centre, hard and indurated around its periphery.

The posterior and upper wall of the meatus are bulging, rendering a view of the deeper parts difficult, but a perforation and some granulations can be made out in the posterior portion of the tympanic membrane.

Operation, March 22d. — The usual mastoid incision opened at once into an abscess cavity lined with granulations, from which there was a copious flow of thick yellow pus. The

mastoid was denuded of periosteum and looked unhealthy; on removing a very thin plate of bone a cavity was entered, filled with pus and granulation tissue, occupying nearly the whole of the mastoid process.

Some of the granulations were taken for inoculation, others for section cutting.

After-history. — Uneventful; made a good recovery.

CASE 12.—**Chronic suppurative otitis media of the left ear with a mastoid sinus.**

G. C. (male), aged eleven years. Admitted to Royal Infirmary, Edinburgh, March 3, 1900.

History. — Some years ago, following acute pain in the left ear, a discharge commenced which has been constant since. Occasionally there have been attacks of pain in the ear followed by a more profuse discharge. About a month ago a swelling formed behind the left ear, broke, discharging pus, and leaving a sinus. Two weeks later, on March 4, 1900, a large firm polypus was removed from the ear by means of a snare. This polypus was kept for microscopic examination.

Present condition, March 10th.—There is a foul-smelling discharge from the left external auditory meatus. Probes passed in by the sinus and meatus cannot be made to touch one another; bare bone can be felt on the floor of the meatus, on the floor of the tympanum, and on the posterior wall of the tympanum.

Operation, March 10th. — The usual incision was made behind the ear, and a radical operation done. Numerous granulations were found in the sinus and in the mastoid antrum. Some granulations were taken from each situation for inoculation.

CASE 13.—**Left chronic purulent otitis media, with cholesteatoma of the mastoid antrum, followed by acute mastoiditis, with Bezold's perforation.**

G. D. (male), aged twenty-four years. Admitted to the Eye, Ear, and Throat Infirmary, March 12, 1900.

History.—Since childhood, and following measles, there has been a discharge from the left ear, which has been continuous, but more abundant at some times than at others; syringing with boracic lotion has been carried out fairly regularly. For the last six months he has suffered a good deal of pain at intervals. Three weeks ago a polypus was removed from the ear; ten days ago a

swelling commenced to form behind this ear, associated with pain, which has been continuous and severe.

Family history.—None of tubercle.

Present condition.—There is swelling and redness over the left mastoid region, and for about three inches down the neck. No fluctuation. There is a little discharge from the ear of thick, curdy, very foul-smelling pus. The meatus is very narrow. All that can be seen is the stump of the polypus recently removed.

Patient has not slept for two days in consequence of severe pain in ear.

Operation, March 14th.—The usual incision for exploring the mastoid was made. The antrum was reached after removing about half an inch of very dense hard bone. In it were found cholesteatomatous masses bathed in curdy pus. When these, and some granulation tissue which was also present at the lower portion of the mastoid process, had been removed, pressure in the neck caused pus to flow into the cavity thus formed, and the probe revealed a perforation on the inner wall of the process near its tip.

An abscess was found beneath the sterno-mastoid muscle which communicated freely with the mastoid wound. The following specimens were taken: pus from mastoid antrum; granulations from the mastoid cells and abscess cavity.

After-history.—The patient made a good recovery, the intense pain being immediately relieved by the operation. The mastoid wound healed by granulation from the bottom in four weeks, as did the neck wound.

Seven months later, the facial paralysis had been completely recovered from; there was still a slight discharge, but no pain had been suffered since the operation.

CASE 14.—**Right acute purulent otitis media, followed by acute mastoiditis with Bezold's perforation.**

A. M. (male), aged twenty-one years; admitted to Royal Infirmary, Edinburgh, Nov. 27, 1900.

History.—Had scarlet fever without complications at twelve years, otherwise has had good health until seven weeks ago, when he says he was seized with influenza, and severe sore throat. Four days after the initial seizure, both tonsils are said to have burst, a discharge of pus coming from each. The same night he felt pain in right ear, which continued four days, then a discharge

appeared and the pain ceased. On three occasions blood was noticed in the discharge during the syringing of the ear.

Four days after discharge commenced, pain returned, and the tissues behind the ear began to swell.

Family history.—No tubercle.

Present condition.—The left pupil is larger than the right, but this, patient states, is the result of previous disease in the eye; the optic discs show nothing abnormal. The right ear stands out markedly from the side of the head, and there is a fluctuating swelling behind it. The skin over the mastoid is red and the tissues are infiltrated over an area the size of the palm of the hand. There is a very profuse discharge of thick yellow pus from meatus. Tympanic membrane cannot be seen owing to rapidity with which pus returns after being cleared away. Pressure over the mastoid increases the rapidity with which the pus returns. Urine shows specific gravity 1.025, no sugar, some albumen, and a trace of blood. There is no desquamation on any part of the body.

Operation, November 28, 1900.—The usual incision down to the bone. This opened an abscess cavity. On removing a very thin layer of bone, granulations were met with, occupying the antrum and the mastoid cells. The granulations were large and numerous, of the œdematous, flabby type, and presented no caseating points; they were red, not pale; they were scraped out, leaving a very large cavity in the bone. A perforation was discovered on the inner wall of the mastoid process, close to its tip.

The bone around the granulations was soft, and showed evidence of rapid destruction, but was not caseous.

Several films were made from pus in abscess cavity, from pus in the antrum, and from an emulsion made from the granulations. Some of the granulations were taken in the usual way for inoculation, and a culture was made on blood serum.

History.—Patient made a rapid and perfect recovery. One month after the operation the wound was healed, the meatus dry, and the hearing good.

CASE 15.—**Left acute mastoiditis with Bezold's perforation following chronic suppurative otitis media.**

Mr. C., age eighteen years; admitted to Private Home, Edinburgh, Nov. 10, 1900.

History.—Has had an intermittent inoffensive discharge from

left ear since childhood. Six or eight weeks ago when mountain climbing in the Highlands he caught a cold; this was followed by a more profuse discharge from the ear. Ten days later a swelling commenced behind the left ear. Syringing was done and powdered boracic acid was blown into the meatus. There was slight improvement for a time, but a week ago the discharge entirely ceased, accompanied by discomfort in the ear and intermittent pain.

Present condition. — There is now no discharge from the ear, and a small perforation is seen in the upper posterior quadrant of the membrana tympani with pouting, pale, and œdematous edges which are of a coral color. There is a large, non-fluctuating, painful, tender swelling, red, brawny, and indurated, over left mastoid process, extending towards the neck, downwards and backwards. No pus can be made to escape from the perforation in the drum membrane, by pressure on the swelling. The left ear stands out from the head much more than the right.

Operation, Nov. 11th.—The antrum was reached after removing about a quarter of an inch of softened bone. It was found filled with granulations; a specimen was secured for inoculation and microscopic examination. A perforation of the inner wall of the mastoid process near its tip was discovered with a probe; with pressure on the neck below, pus welled up into the wound. A counter opening was made in the neck; the posterior wall of the meatus and the tympanic cavity were not interfered with. The granulations were dark red, not flabby nor caseating.

After-history.—The patient made a complete and uneventful recovery.

CASE 16.—**Chronic suppurative otitis media of right ear, with mastoiditis and cholesteatomatous masses.**

C. S., male, aged six years. Admitted to Royal Infirmary, Edinburgh, Nov. 9, 1900.

History.—When a few months old he had an attack of acute inflammation in the right middle ear, accompanied by pain. The existence of severe pain is demonstrated by the history. A discharge was noticed after a few days, and has been continued to the present time. There is no history of measles or other acute disease. Attacks of pain have occurred in the ear from time to time; occasionally also pain was complained of behind the ear.

Since the discharge commenced, treatment has been regular.

About three weeks ago severe pain commenced in the affected ear, with a painful swelling over the mastoid region, which soon became red. During the last few days the pain, swelling, and redness have been less marked.

Family history.—None of tubercle.

Present condition, Nov. 10th.—There is a copious foul-smelling discharge from the right ear, but no pain is complained of. After syringing, the posterior wall of the meatus is seen to be bulging into it in the form of a cone. From the apex of the cone pus is escaping, and into it a small probe can be passed and bare bone felt. It is impossible to get a good view of the tympanic membrane, on account of this projection of the meatal wall. The parts about the mastoid are tender to touch, but there is now very little swelling and no redness.

Operation, Nov. 11th.—The usual mastoid incision was made, and the bony external auditory meatus exposed. The tympanic membrane was found to be entirely gone.

The mastoid antrum, when opened by Stacke's method, was found of large size, and contained cholesteatomatous masses and granulations. (Some of the latter were taken for inoculation.)

The granulations were red and of medium size.

After-history.—Two months later ear still discharging.

CASE 17.—**Chronic suppurative otitis media of left ear.**

L. F., female, aged three years and ten months. Admitted to Royal Infirmary, Edinburgh, Dec. 18, 1900.

History.—When one year and nine months old, after three days' severe pain in the left ear, a discharge of thick yellow pus commenced, and has continued the same ever since. As soon as discharge appeared, the pain ceased. Never had measles or scarlet fever; a few months ago had whooping-cough, from which she made a good recovery.

Treatment has been regular ever since the commencement of the disease. Every few months there have been periods of pain, associated with retention of discharge. About three weeks ago she had an unusual attack of this kind, and the family doctor stated that he found her temperature 100.2°. On this occasion also the discharge was absent, but reappeared in two days with subsidence of pain. During the last six months she has disliked having her head touched in any way, as it seemed to cause pain.

Family history.—None of tubercle.

Present condition.—Pale, ill-nourished child. There is a thick discharge of yellow fœtid pus, which is sometimes rather watery; there is no swelling over the mastoid region on the left side, nor any standing out of the left ear. No enlarged glands can be felt in the neck. There is a small perforation at the lower posterior quadrant of the tympanic membrane. This membrane is dull grayish-white, thick, and sodden-looking; no granulations are seen. There is some bulging and reddening of the posterior meatal wall; the discharge is very free.

Operation, Dec. 23d.—Mastoid antrum opened; contained nothing abnormal. Lotion was syringed in by the wound, and came out by the meatus.

I was unable to obtain anything for inoculation or examination. (On several occasions previous to the operation I stained films of pus, taken from the surface of the drum at the perforation.)

After-history.—The mastoid wound healed fairly rapidly, but discharge continued from the left ear. On January 8, 1900, the right ear commenced discharging. A month later there was still a very slight discharge from both ears.

CASE 18.—**Right chronic suppurative otitis media, with acute mastoiditis.**

A. R., male, aged eight and a half years. Admitted to Royal Infirmary, Edinburgh, Jan. 16, 1901.

History.—Has had an intermittent chronic discharge from the right ear since two years old, following measles. Nasal-pharyngeal adenoids were removed at three years. Left ear has discharged occasionally. A week ago a swelling rapidly appeared behind the right ear, which was larger then than at present; there was a little pain the first day only. Discharge from the right ear has come on about every four to eight weeks and has lasted about one week. Attacks of this kind have been recurring since the first onset.

Family history.—No tubercle.

Present condition, Jan. 19th.—Right external meatus contains a quantity of foul-smelling, thick, yellow pus, which, when syringed away, shows a tympanic membrane of purplish color, with some whitish-gray flakes upon it. There is distinct pulsation just in front of the umbo, revealing the position of the perforation. There is no bulging of the posterior upper wall of the meatus. Behind the right ear, over the mastoid, there is a large

fluctuating swelling, rather larger than a five-shilling piece, painful only when touched. No head symptoms.

The abscess over mastoid was opened by Wilde's incision, and about half an ounce of pus escaped.

Operation, Jan. 20th.—The previous incision was enlarged, the mastoid exposed; no suprameatal spine being present the external auditory meatus was taken as the guide. The gouge was applied half an inch behind its upper margin, in the meatal triangle. When bone to the depth of about half an inch had been removed in this position pulsation was noticed, and the wall of the lateral sinus was found exposed, its anterior edge being within half an inch of the external auditory meatus. The mastoid antrum had been opened at the same time; a few granulations were found in it and were taken for microscopic examination, as well as a gland from over the mastoid process.

After-history.—Patient made a good recovery.

CASE 19.—**Left acute suppurative otitis media followed by acute mastoiditis.**

Mrs. W., aged forty-seven. Admitted to Royal Infirmary, Edinburgh, Jan. 13, 1901.

History. — Hearing has been impaired since an attack of measles in childhood, but she has not had any other trouble with her ears until ten days ago, when she was attacked with sudden pain in her left ear, following a cold in the head. The pain continued for two or three days, when something burst in her ear, and immediately afterwards a red discharge came from it. The onset of discharge did not result in relief of the pain, but the position of the pain changed from the ear to behind it, extending upwards over the head, and downwards into the neck. A thick yellow pus discharged has been continuous and profuse since its onset. No rigors or vomiting.

Family history. — None of tubercle.

Present condition. — Has a flabby alcoholic appearance. The temperature normal. Pulse 75, weak, and compressible. There is marked pain and tenderness over the region described; also a profuse discharge. After syringing, immediate inspection shows a congested, bulging membrane, with a large perforation situated in the anterior inferior quadrant, with thick œdematous edges, from which pus wells up quickly; no bulging of the meatal wall, but slight fulness over the mastoid process and region generally.

The left auricle does not stand out more prominently than the right.

The patient can hear a slightly raised conversational tone in the affected ear at a distance of about one inch. Watch only heard on contact. Urine normal.

Operation, Jan. 31st. — The mastoid periosteum was very adherent. On chiselling away one quarter of an inch of cortical layer of bone, the mastoid cells were reached and found filled with granulations; no large antrum cavity was found, but the aditus was determined and a probe passed into it. The posterior meatal wall was not in any way interfered with. (Some granulations from the mastoid cells were reserved for inoculation, and others for section cutting.)

After-history. — Recovery progressed favorably for a week after the operation. I was unable to follow the history further.

METHODS OF INVESTIGATION.

Inoculation Methods.

Villimen in 1865 first described subcutaneous inoculation of animals for the detection of tubercle, and Delépine's experiments have proved the guinea-pig the most suitable animal. Cohnheim and Solomonsen in 1877 devised the plan of inoculation into the anterior chamber of rabbits and got good results. Many competent observers hold that the most reliable proofs for tubercle can be obtained by inoculation— *e. g.*, Arloing, Leloir, Verneuil, Milligan.

In carrying out my experiments, I have adopted the intraperitoneal method of inoculation, as usually carried out at the Laboratory of the Royal College of Physicians, Edinburgh, slightly modified, in preference to the subcutaneous method of Delépine. All instruments and utensils used were sterilized, and the most careful antiseptic precautions taken throughout all the experiments.

The tissues for examination, which consisted of granulations and scrapings of bone from the most actively spreading portions of the disease, were pounded in a mortar with a little sterile normal salt solution, and the more liquid portion was injected with a syringe into the peritoneal cavity of a guinea-pig.

Two healthy guinea-pigs were usually taken for each experiment, the second being used as a control.

The guinea-pigs inoculated from the same case were always kept by themselves in one cage; their weights were taken at the time of the inoculation and again at intervals of a week or ten days, until they died or were killed after a period of five or six weeks.

At the post-mortem dissection of the guinea-pigs, the seat of inoculation was observed, as well as the peritoneum and all the abdominal organs; their naked-eye appearances carefully noted, while all, or at least some portion, of the following organs and tissues were taken for microscopic examination, viz.: the great omentum, a mesenteric gland, if enlarged, the spleen, a piece of liver, and a kidney. If any part of abnormal appearance was observed, that portion, especially, was secured for further examination. The thorax was then opened, and its glands and organs examined and dealt with as in the abdomen. On a few occasions, blood-serum tubes were inoculated and cover-glass films made from tuberculous nodules.

Preparation of specimens for cutting.—This was done in one of the three following methods: 1st. Corrosive-paraffin method. 2d. Absolute alcohol-paraffin method. 3d. Formaline-paraffin method, and cut with a Cambridge rocking microtome.

I used egg albumen prepared as follows, for fixing my sections to the slide: To 10 *ccm.* white of egg 100 *ccm.* of distilled and sterilized water were added, and the two shaken thoroughly together, then filtered into a bottle, and 10 *ccm.* of absolute alcohol added and thoroughly shaken and kept tightly corked.

The chief advantages I found in the egg albumen, prepared as I have described, were: 1st. It was not so sticky and dirty as that prepared with glycerine, yet quite sufficiently adhesive to hold any specimen perfectly to a slide, including tissue fixed in formaline. 2d. That it kept perfectly for months, and was always ready for use, thus being superior to egg albumen and distilled water alone (Mann's method[1]), which has to be made fresh as required.

[1] Muir and Ritchie, *Manual of Bacteriology*, page 102.

Methods of staining: A.— For sections fixed by corrosive and absolute-alcohol methods, this was done by the ordinary Ziehl-Neelsen method with filtered carbol-fuchsin for twenty-four hours in cold stain, or for one hour in same stain in an incubator at 35° C., decolorized with twenty-five per cent. sulphuric acid, and then in methylated spirit for five or ten minutes; counter stained with methylene blue, dehydrated with absolute alcohol, cleared in zylol, and mounted in balsam, with No. 1 cover slip; for films the same stain was used by the ordinary watch-glass and heat method.

B.—For sections fixed in formaline a modification of the above method was found necessary.

The organs from four guinea-pigs, which showed marked naked-eye tuberculous infiltration, were fixed in Joel's fluid — a preservative containing formaline. When the sections prepared in this way came to be stained by the ordinary carbol-fuchsin method, it was found that they took the stain badly; only a few bacilli took the stain, and although the character of the tissue could be made out to be tuberculous, its definition was cloudy and indistinct; in fact, in many of the sections bacilli could not be demonstrated at all by this method; yet from the microscopic appearance of the tissue one felt certain that they must be present. (The chief laboratory assistant and other experienced stainers also stained sections, with exactly the same result as my own.) Consequently I came to the conclusion that the formaline in which the tissue was fixed must in some way be interfering with the action of the stain. In discussing my difficulty with Dr. Noël Paton, he suggested that the imperfect staining might be due to formic acid, and advised soaking the sections in some alkaline solution before staining; consequently, after removing the paraffin in the usual way, I placed the sections in solutions of liquor ammoniæ and liquor sodæ with methylated spirit. After many experiments, the best results were found to be attained by putting the sections for fifteen to twenty minutes in a solution of liq. ammoniæ, 1 in 40 of methylated spirit; after the above treatment, the time required did not exceed five minutes for decolorization, which was done in the ordinary way. By

this modification of the carbol-fuchsin method, these formaline fixed sections could be perfectly stained and made to show distinctly the structure of the tissue, the caseous nodules, the tubercle bacilli, and epitheloid cells. In some of the sections, which by the ordinary method showed no bacilli, or only a few, this method showed them to be present in great numbers.

C.—For tissue elements the staining was done by the ordinary hæmatoxylin and eosin method.

The microscopic examination of specimens.—This was done with one-fourth, one-sixth, and one-twelfth (oil immersion) lenses, a mechanical stage being used.

Microscopic and Inoculation Experiment Reports.

Case 1.—M. W. The left mastoid gland and the granulations from the left mastoid antrum, removed at the operation, Dec. 27, 1900, were prepared for section cutting by the absolute-alcohol method, and the sections stained by staining method A (as were all specimens in this case).

Sections of the gland show numerous caseating areas in various degrees of advancement, a few giant cells, numerous epitheloid cells, and tubercle bacilli. The bacilli are most numerous in the more advanced caseating areas; here the bacilli have mostly the beaded appearance.

The bacilli in and about the epitheloid cells are less numerous, and do not present the beaded or spored appearance, being stained throughout their whole length. In several microscopic fields, with a one-twelfth inch oil immersion lens, between twenty and thirty bacilli were counted. Some portions of this gland present the normal lymphoid appearance, with no epitheloid cells or bacilli.

The granulations above mentioned were pale and flabby, and caseous-looking points were visible in them. The caseating foci were very distinctly seen during the process of rubbing up, in sterilized salt solution, in preparation for inoculation into the guinea-pig, the residue in the mortar having an appearance closely resembling grated cheese. Microscopic sections of these granulations show much the same appearance as that seen in the gland just described, there being caseating areas, epitheloid cells, and tubercle bacilli, but no giant cells. In one field more than

sixty of these bacilli were counted, and, as in the last specimen, they are most numerous in the caseating areas, where most of them show the beaded appearance.

An emulsion was made of some of the granulations and centrifuged; films made from the deposit and stained for tubercle failed to give a positive result.

Sections of the adenoid tissue removed from the naso-pharynx and stained for tubercle show numerous advanced caseating areas, and around them epitheloid cells. In some of these nodules tubercle bacilli are seen in great number; more than a hundred were counted in one one-twelfth inch microscopic field. Some of them are single rods, stained throughout; others have the spored appearance; several have the V-shape arrangement; and a few look as if they were branched.

The mucous membrane removed from the mastoid antrum and tympanum of the right ear, when cut and stained, shows microscopically numerous caseating areas in various stages of advancement, around which are many epitheloid cells. Tubercle bacilli are also present.

Sections from the right tympanic membrane (which on its external surface looked normal, and on its mucous surface showed thickening and pale nodules) are found microscopically to disclose the following characteristics: Its whole stratum mucosum is infiltrated with the tuberculous process, and tubercle bacilli are present in considerable number, especially towards its tympanic surface. No giant cells are present. The mucosa is much thickened, and the caseous degeneration extends throughout its whole substance. The fibrous membrana propria is very largely unaffected, although the mucosa in immediate contact with it is in an advanced stage of tuberculous degeneration; at a few points, however, it has been partially destroyed by the disease and has almost disappeared, while here and there throughout its substance a tubercle bacillus is seen in what otherwise looks normal tissue. At the parts of the membrana propria where destruction has taken place, the appearance is that of erosion and not of infiltration. The cuticular layer is more extensively involved than the membrana propria. It shows a considerable number of tubercle bacilli in various parts, and a few epitheloid cells, showing that the disease was commencing to make rapid progress there. The condition of the membrana propria shows that its fibrous structure offers a stubborn resistance to the spread of the disease to the

cuticular layer. Sections from the anterior mediastinal gland, as well as those from the lung and a mesenteric gland, show caseating nodules, epitheloid cells, and bacilli; in those of the great omentum a few giant cells are seen as well. Glands near the right and left Eustachian tubes and a gland from under the sternomastoid show tuberculous infiltration, caseation, epitheloid cells, and bacilli in great number. Sections of the left Eustachian tube, at different levels, show the whole mucous membrane and the submucous layer of adenoid tissue beneath it infiltrated with tubercle. In fact, nearly all the adenoid tissue normally present in children in this situation has been replaced by granulation tissue, which in many parts has undergone tuberculous degeneration.

The tissues around the submucous adenoid layer are only slightly infiltrated at their junction with the latter. Bacilli are seen in considerable number throughout the submucous layer, but not beyond it. In a gland shown in the same section, and about $\frac{1}{4}$ of an inch from the Eustachian tube, advanced caseation and bacilli in great numbers are found. In one microscopic field, between three and four hundred bacilli were counted, but they were so numerous that it was impossible to count them accurately. The tissue between the submucosa and this gland shows no sign of tuberculous involvement. A gland situated near the right Eustachian tube shows a very similar appearance to the corresponding one on the left side. The cartilage around the left tube, the muscular and fatty tissues, and the mucous glands situated in the immediate neighborhood have not been attacked.

Sections from the pia mater and from the left temporo-sphenoidal lobe of the brain, immediately over the tympanic roof in the middle cranial fossa, show no evidence of tubercular involvement, neither does the tissue from the pharyngeal wall in the immediate neighborhood of the adenoid tissue which has been previously described as showing advanced tuberculous change.

Hæmatoxylin- and eosin-stained sections of the right Eustachian tube and carotid artery in the bony portion of the canal show the mucosa of the Eustachian tube much thinner and less involved than in the cartilaginous portion of the left tube. The adventitia of the right carotid is much thickened, but otherwise unaltered.

Granulations from the mastoid antrum were prepared and inoculated on Dec. 27, 1900, into guinea-pig No. 25 : weight then

712 grms., on Jan. 21, 1901, 675 grms., and on Jan. 29, 1901, 530 grms. On this date it was killed and on dissection showed general tuberculosis. There was a caseous nodule at the seat of inoculation.

Microscopic sections, of the spleen and great omentum, show caseating areas, epitheloid cells, and tubercle bacilli.

CASE 2.—M. McI. Granulations, including some bone tissue from the left mastoid, were prepared and inoculated into guinea-pig No. 17 on Oct. 4, 1900, its weight then being 610 grms. On Nov. 15th, it weighed 460 grms. (*i. e.*, 42 days after inoculation); it was then killed and dissected, and showed a caseous nodule at the site of inoculation, and general tuberculosis.

Films were made from caseous nodules in the spleen, great omentum, and site of inoculation, but none of them show tubercle bacilli. The spleen, great omentum, and a lumbar gland were prepared for section cutting by the absolute-alcohol method. The sections chosen for staining (method A) were those passing through a nodule; they all show typical tuberculosis, caseous degeneration, epitheloid cells, and tubercle bacilli, but no giant cells. Two films were also prepared from a piece of granulation from the mastoid, and stained, but show no tubercle bacilli.

CASE 3.—A. H. Granulations were taken from the wall of the cavity in which the sequestrum was found, on Oct. 21, 1900. They were prepared as usual, and inoculated into guinea-pig No. 20, Oct. 2d, which then weighed 528 grms. It died on Nov. 23d (31 days after inoculation), its weight being 392 grms. Typical tuberculous nodules were found in several organs. Sections prepared from the spleen and the lumbar gland, stained for tubercle (method A), show numerous caseous nodules, degenerative changes, epitheloid cells, and tubercle bacilli, but no giant cells.

One film from a nodule in the spleen, at the time of dissection, shows tubercle bacilli. None were found in several other films examined.

CASE 4.—E. E. M. The granulations and a scraping of bone, taken from the mastoid antrum on May 22, 1900, were prepared and inoculated into guinea-pigs Nos. 13 and 14, by the usual method on May 25th. (The delay in making the inoculations in this case and the next, was owing to the impossibility of obtaining guinea-pigs sooner.)

At the time of the inoculations, the guinea-pigs weighed 527

and 490 grms., respectively; on June 3d, 502 and 470 grms. On July 10th, No. 13 died; it then weighed 330 grms. On dissection it showed general tuberculosis. The whole guinea-pig was placed in Joel's fluid.

On July 13th, No. 14 was killed; it then weighed 343 grms. It showed general tuberculosis also. This guinea-pig was also placed in Joel's fluid. After allowing these guinea-pigs to remain in this fluid for two weeks, the liver, spleen, and the great omentum were taken from each and prepared for staining by methods A and B.

Sections of the above stained by staining method A did not take the stain well, and although they show numerous caseating nodules and badly stained epitheloid cells, only a few imperfectly stained bacilli were seen in a few of the sections. By soaking similar sections in 1 in 40 liquor ammoniæ before staining, as previously described under "Methods" (staining method B), the tissues were much better stained, numerous bacilli were demonstrated having all the typical characteristics of tubercle bacilli.

Case 5.—D. P. Granulations and bone scraping were taken from the mastoid antrum, and also granulations from the walls of the suppurating cavity in the neck, on May 23, 1900.

The solution prepared from the former was inoculated into guinea-pig No. 15, and that from the latter into guinea-pig No. 16, on May 25th; No. 15 then weighed 492 grms., and No. 16, 542 grms.; on June 3d, they weighed, respectively, 480 and 562 grms. No. 15 died on July 13th; it then weighed 322 grms. On the same day — that is, nine weeks after the inoculation,—No. 16 was killed, its weight being 360 grms.

Both these guinea-pigs showed general tuberculosis. These guinea-pigs were put into Joel's fluid, and two weeks later the great omentum, spleen, a piece of liver, and other affected parts were prepared for section cutting by Method 3.

Sections of those organs when stained by staining method A, show exactly the same imperfect results as the sections from the guinea-pigs Nos. 13 and 14, similarly stained, but when treated with ammonia solution, by staining method B, they showed tuberculous degeneration, caseation, epitheloid cells, and tubercle bacilli in the most typical manner.

Guinea-pigs Nos. 13, 14, 15, and 16 had each a large caseous nodule at the site of inoculation, on the seventeenth day.

Case 6.—H. G. The granulations from the cavity in which

the sequestrum was lodged were prepared and inoculated into guinea-pigs Nos. 18 and 19, Oct. 17, 1900. On Nov. 27th, No. 19 died, and on Nov. 28th, No. 18 died.

On dissection, no naked-eye evidence of tubercle was found in either. In microscopic sections of the spleen and great omentum no degenerative changes could be found.

At the post-mortem examination of the body of H. G., an enlarged mesenteric gland was taken and prepared for cutting (corrosive method). Microscopic sections show no degenerative changes, or other evidence of tubercle.

A portion of the right temporal bone, including a portion of the wall of the cavity, in which the sequestrum was situated, and with the granulation tissue on its surface, was placed in Pereny's fluid to decalcify. Microscopic sections, prepared and stained for tissue elements and tubercle, show nothing indicating tuberculous degenerative changes.

Case 7.—A. R. Granulations, from the walls of the cavity in the temporal bone, from which the sequestrum was removed on Nov. 4, 1900, were prepared and inoculated into guinea-pig No. 21, on Nov. 5th ; weight 488 grms. On Nov. 27th it died ; weight 494 grms. On dissection, it showed no tubercle. Microscopic sections of the spleen and great omentum, stained for tubercle by staining method A, show no evidence of tubercle. Several films of the pus from the right external auditory meatus, taken on Nov. 14th and stained for bacilli, also showed none. A small gland removed on Dec. 22d from near the diseased ear showed degenerative changes in places and also a considerable number of cells exactly like epitheloid cells, but no giant cells or bacilli.

Case 8.—W. C. The granulations removed from the mastoid April 29, 1900, were prepared and inoculated into guinea-pig No. 12 on April 30th; it then weighed 580 grms.; on May 10th, 594 grms; on May 20th, 605 grms.; on June 19th, 650 grms. On this date it was killed and its organs and glands were found normal.

Case 9.—A. T. Pus was taken on a sterile swab from the surface of the right tympanic membrane, mixed with some sterile salt solution in a sterile dish, and inoculated into guinea-pig No. 4 on March 15th. Weight at the time of inoculation 620 grms; on March 19th, 622 grms. On the 29th it died—that is, thirty-one days after inoculation. The dissection showed no evidence of tubercle, and the microscopic inspection of section from spleen showed no degenerative changes.

CASE 10.—R. H. The scraping which was taken from the tympanum was prepared and inoculated into guinea-pig No. 5 on March 20, 1900, its weight then being 597 grms.; on April 2d it weighed 422 grms., and on the 8th of April it died, and that is nineteen days after inoculation. It showed no evidence of tubercle in any part.

CASE 11.—W. McK. A solution was prepared from the granulations from the mastoid and inoculated into guinea-pig No. 6 on March 21, 1900. The guinea-pig then weighed 574 grms.; on April 2d it weighed 444 grms.; on April 27th it died and was dissected; no evidence of tubercle was found. Microscopic sections of the spleen show no degenerative changes. Granulations from the mastoid show ordinary granulation tissue, and in a few places some large cells, but no caseation of bacilli.

CASE 12.—G. C. Granulations from the mastoid were inoculated into guinea-pig No. 1 on March 12, 1900. The guinea-pig then weighed 670 grms., and on March 19th, 640 grms.; on March 22d, 628 grms.; April 2d, 547 grms.; on May 17th, 515 grms.; and on the same day it was killed and dissected. Organs found normal. Granulations from the abscess cavity over the mastoid were prepared and inoculated into guinea-pig No. 2 on March 12th, which then weighed 752 grms.; on March 16th, 647 grms.; March 19th, 727 grms.; March 22d, 693 grms.; and April 2d, 547 grms. This guinea-pig died on April 7th, twenty-six days after the inoculation. Dissection revealed no naked-eye evidence of tubercle. The spleen and great omentum of both show no tuberculous changes in their structure microscopically.

Sections of the aural polypus removed from the patient show it to consist chiefly of granulation tissue, without degenerative changes.

CASE 13.—G. D. The granulations removed from the mastoid were prepared and inoculated in guinea-pig No. 3 on March 15, 1900, weight 717 grms.; on March 19th, 737 grms.; on March 29th, 760 grms.; and on April 16th, 780 grms. It was killed on the last date. No naked-eye evidence of tubercle was found. Microscopic sections from the liver and spleen show no degenerative changes.

A streak culture was made on agar-agar of pus from mastoid antrum; after twenty-four hours a whitish culture was found, which on microscopic examination proved to consist of small

narrow bacilli and streptococci. The bacilli were quickly decolorized by acid.

Some antrum granulations showed microscopically ordinary granulation tissue without degenerative change or bacilli. Several films of pus from the external ear showed numerous small bacilli and various kinds of cocci, but no tubercle bacilli.

CASE 14.—A. M. Films of pus from external auditory meatus show cocci in chains and groups. During the operation, films of pus were taken from mastoid antrum; they show cocci in chains and groups, but no tubercle bacilli. Some granulations from antrum were prepared and inoculated into guinea-pig No. 24. Films from granulation solution showed nothing but cocci in chains and groups, as did the pus films.

No. 24 guinea-pig was inoculated on Nov. 29, 1900; it then weighed 282 grms.; on Dec. 8th, 260 grms. It died on Dec. 18th, nineteen days after inoculation. The dissection showed no evidence of tubercle. The microscopic sections, prepared from its spleen and great omentum, show no degenerative changes or bacilli.

Granulations, from the mastoid, show young granulation tissue, but nothing indicating tuberculosis.

CASE 15.—Mr. C. The granulations from the mastoid antrum were prepared and inoculated into guinea-pig No. 22 on Jan. 11, 1900, its weight then being 502 grms. Fifteen days after inoculation it died, its weight being 514 grms. In the peritoneum near the seat of the inoculation there was a small gray point of the size of a pin's head; five or six other similar points were found in the great omentum. Films were made from two of these. Other organs showed no abnormal appearance to the naked eye. Microscopic sections of the spleen and great omentum and the films show no changes indicating tuberculosis.

CASE 16.—C. S. Granulations taken from the mastoid on Nov. 11, 1900, were prepared and inoculated into guinea-pig. No. 23 the same day; this guinea-pig then weighed 445 grms.; it died four days later, of what cause is unknown, as all its organs looked normal.

CASE 17.—L. F. On several occasions more than a dozen films of the pus from the external auditory meatus were stained, which showed the following: numerous groups of cocci arranged as diplococci and staphylococci, and also a large number of stout short bacilli, quickly decolorized by the 25 per cent. sulphuric

acid, and also many small thin bacilli, which held the red stains more strongly than the first described, but in no way resembled tubercle bacilli.

CASE 18.—A. R. The granulations removed from the antrum Jan. 20, 1901, were prepared by alcohol method. They show ordinary granulation tissue only. Sections of the mastoid gland, removed at the same time as the granulations, show no degenerative changes.

CASE 19.—Mrs. W. The granulations taken from the mastoid at the operation Jan. 31, 1901, were prepared and inoculated on the same day into guinea-pig No. 25a, which then weighed 574 grms. On March 21st it was killed and then weighed 712 grms. The dissection showed it to be perfectly healthy.

RESULTS OF BACTERIOLOGICAL DIAGNOSIS, ETC.

Inoculation.—The presence of a *caseous nodule at the site of inoculation* is, I believe, an important point in determining whether a guinea-pig which is found tuberculous is so as the effect of inoculation. Of the eight guinea-pigs which were found tuberculous on dissection during my experiments, all showed tuberculous nodules at the site of inoculation on the seventeenth day.

My experiments also demonstrate that, where naked-eye tubercle is not present in some of the abdominal lymphatic glands, the great omentum or spleen of a guinea-pig after intraperitoneal inoculation, it is unnecessary to seek for it by microscopic inspection in sections of these tissues.

It is doubtful if the inoculation of a guinea-pig intraperitoneally with pus suspected of being tuberculous is a reliable method of investigation, judging from the result obtained in Case 9, for here the clinical history and symptoms pointed strongly to the ear disease being tuberculous, yet the inoculation experiment gave a negative result. Previous observers[1] have shown that, as a rule, very few tubercle bacilli are present in tuberculous pus, hence all this experiment proves is that tubercle bacilli were absent from the pus experimented with. The result of the experiment,

[1] Schlegendal, quoted by Cheyne in his work, *Tuberculous Disease of Bones and Joints*, p. 79.
Cheyne (W.), *Tuberculous Disease of Bones and Joints*, p. 80.

nevertheless, is instructive, as it demonstrates one important fact, namely, that a guinea-pig injected intraperitoneally with pus may not necessarily develop septic peritonitis, for it lived twenty-three days after inoculation, and on dissection showed neither peritonitis nor tubercle. The whole of my inoculation experiments tend to bear out the view that guinea-pigs are but slightly susceptible to septic organisms, and are consequently suitable for the detection of tubercle. Of the 26 guinea-pigs inoculated by the intraperitoneal method during my experiments, only one, that in Case 16, died before the seventeenth day, when tubercle, if present, would have been visible to the naked eye, according to Delépine's researches.

Granulations.—A method of investigation recommended by Brieger seems to hold out a promising result; it is that of securing a granulation or a small piece of the diseased mucous membrane from the middle ear, and examining microscopic sections of it for caseating areas, epitheloid cells, and bacilli. I was able to do this in only one of my cases, which proved to be tuberculous, Case 1; but the changes found were most pronounced and definite. Granulations from the mastoids of several other cases (6, 11, 13, 14, and 18) were examined in a like way with a negative result, and in each the inoculation experiment confirmed the negative opinion formed from the microscopic appearance of these specimens. The microscopic examination of an enlarged mastoid gland would also throw valuable light on the diagnosis when the ear on the same side is diseased, *e. g.*, Cases 1 and 18.

Films.—The staining of films of pus from the tympanum is an aid to diagnosis in tuberculous otitis; but the small number of tubercle bacilli usually found in pus renders this method very laborious as a means of demonstrating that organism. A dozen or more films may be stained for bacilli in a known tuberculous case, without giving a positive result. In guinea-pigs, even when the films are made direct from a tuberculous nodule, my experience is that this method is not very satisfactory, as not more than 15 % of such films show the bacillus.

Staining.—I have given a short account of my experience of staining, under "Methods."

GENERAL CONSIDERATION OF THE RESULTS OF INVESTIGATIONS AND CONCLUSIONS.

Results of Case 1 Specially Considered.

The results of the post-mortem examination of M. W. (Case 1. See Plate I. Figs. 1–3) are specially instructive, and demonstrate that in a case of tuberculosis of the middle ear tuberculous nasopharyngeal adenoids of considerable size may exist, without giving rise to symptoms which cause their presence to be suspected. Had an examining finger been passed into the naso-pharynx in this case, they could scarcely have been overlooked, as the mass of lymphoid tissue found there was about three-quarters of an inch long and from a quarter to half an inch thick and much lobulated. This fact indicates that in similar cases the condition of the naso-pharynx should be investigated, and should adenoids be found their removal and microscopic examination would give valuable indications as to the nature of the ear disease.

The advanced tuberculous degeneration found in the mucous membrane of the right tympanum and antrum without producing objective ear-symptoms is also of importance. Here careful inspection of the outer surface of the right tympanic membrane, both ante mortem and post mortem, revealed nothing abnormal, beyond perhaps a slightly abnormal pallor; yet when the tympanic cavity was open, post mortem, its mucosa was found much thickened, and studded with numerous elevated gray tubercles (Fig. 2).

The naked-eye and microscopic appearances presented by the mucosa covering the inner wall of the tympanum, tympanic membrane, and antrum, did not demonstrate at which of these sites the disease first appeared, since it was equally advanced in all of these positions, numerous caseating areas, epitheloid cells, and bacilli being present in all parts of the middle-ear mucosa.

The microscopic examination of the right tympanic membrane brought out many interesting facts. The whole of

the stratum mucosum was found in an advanced stage of tuberculous degeneration, while the fibrous membrana propria immediately external to it was comparatively healthy, there being no infiltration of its substance; but it was being gradually absorbed at several points of its inner surface, showing that this layer of the drum membrane offers considerable resistance to infiltration by the disease. The erosion into this fibrous layer was deeper at some positions than at others, and it may be assumed that the destructive process would have been completed first at the thinned places, with the result that perforation of the whole thickness of the membrane would first have been completed at the corresponding sites; and this, I believe, explains how multiple perforations of the tympanic membrane are formed in tuberculous myringitis. In the membrana propria, although no epitheloid cells or degenerative changes were present, a few tubercle bacilli were seen along the small vessels. This point indicates not only that this membrane resists infiltration of its substance by tubercle, but that the bacilli are only able to find their way, in the early stages of the disease, to the skin layer, along the vessels which effect a communication between the vessels of the mucosa and those of the cutis vera, and that it had been by this means that they had reached the latter in this case.

The presence of epitheloid cells and a greater number of bacilli in several parts of the cutis vera of the drumhead show that the disease had here found a more favorable footing than in the membrana propria, and that once a perforation of the membrana propria had occurred destruction of the cutis vera over it would soon have followed.

The comparatively early stage of the tuberculous process in the skin layer and the unperforated state of the fibrous layer account for the absence of objective symptoms in this case. According to Brieger,[1] a post-mortem examination of a tuberculous middle ear previous to perforation of the drum membrane has very rarely been obtained, consequently the appearances observed—naked eye and microscopically—in this case are of considerable interest, and, so far as can be

[1] *Transactions Sixth International Otological Congress*, 1899, p. 21.

gathered from a careful search of the literature of early middle-ear tuberculosis, the changes observed microscopically in this tympanic membrane (p. 220, lower half) have not previously been described.

That advanced tuberculous infiltration of the mucous membrane of a middle ear may occur without producing objective symptoms in the outer surface of the tympanic membrane, is proved by the observations just recorded. How long the right middle ear had been tuberculous (in this case) must be a matter of conjecture; yet when one considers the comparatively slow progress of tuberculous infiltration and degeneration as observed in tuberculous guinea-pigs, it may be assumed that the disease had been present in this tympanum for at least two weeks.

The path taken by the bacilli in finding their way to the tympanum, in this particular case, was clearly by the Eustachian tube, as they were traced from the tuberculous adenoids in the naso-pharynx along the sub-mucous and lymphoid tissue layers of the Eustachian tubes (as shown by the sections made from different levels of the tubes, already described), and this view is confirmed by the absence of tuberculous infiltration in the tissues of the tubes and right middle ear other than their lining membrane, which would have been infiltrated by the disease had the bacilli found an entrance from the general system by the arterial supply, and on the right side the condition of the tympanic membrane proves that they did not find an entrance through it.

Although it cannot be proved that the first bacilli which reached the right tympanum did not get there mechanically, by means of a fragment of infected mucus from the naso-pharynx being forced up the tube by air pressure, it is much more probable that they entered by direct extension along the submucosa of the tube, since tuberculous infiltration was present in the lining membrane of tube throughout its whole length.

Microscopic sections of granulations from the left middle ear (Case 1) likewise show typical tuberculous degeneration, caseation, epitheloid cells, and bacilli, and the glands along

the Eustachian tube, the mastoid glands, and other glands in the neck were similarly affected.

Another point of interest observed was the great number of bacilli present in the mucous membrane of the right and left middle ears, in the lymphoid tissues along the tubes, as well as in the lymphoid tissue in the naso-pharynx.

The mastoid gland and granulations from the middle ear on the left side were examined ante mortem and gave positive results, consequently similar microscopic examination in other cases might prove helpful in diagnosis.

The free passage of blood down the Eustachian tube during the operation on Case 1 supports Ostmann's theory,[1] that in wasting diseases the Eustachian tube becomes more patent, and the extreme thinness of the left tegmen tympani and the pallor of the dura mater over it show that the disease was making its way towards the brain.

Analysis of Cases.

The following facts are brought out by an analysis of the nineteen cases investigated:

Percentage of tuberculous cases. — A satisfactory proof as to the presence or absence of tubercle was obtained in 18 of my cases, 5 being tuberculous and 13 non-tuberculous; in the remaining case tubercle cannot be held to have been excluded; thus tubercle was the cause of the ear disease in 26.3 % of the cases investigated. In 21 % of the cases (6, 7, 10, and 11) in which tubercle might have been expected, inoculation experiment proved it to be absent. Microscopic examination of mastoid granulations in two of the cases (6 and 11) confirmed the negative result obtained by inoculation experiment.

Ages. — The ages of the five cases in which tubercle was proved varied from five months to seven and a half years, four being under five years. The ages of the thirteen non-tuberculous cases ranged between three years ten months and forty-seven years, three being under five years.

This result points to the greater frequency of tuberculous

[1] *Wiener medicinische Presse*, 1898, p. 662.

otitis in children under five years than in persons over that age.

Condition of the bone. — Twelve (or two-thirds) of my cases showed destruction of bone in the neighborhood of the middle ear, while only 5 (or 41.6 %) of these were tuberculous, thus showing that over 50 % of my cases with bone lesion were non-tuberculous, a result which is in marked opposition to Milligan's statement[1] that "a large proportion of the cases of suppurative middle-ear disease with accompanying bone lesion met with in practice are tuberculous." If we consider separately my cases which were under five years of age we arrive at a different result, for we find 66 % of those with bone lesion were tuberculous, while in those of my cases over five years only 16 % were tuberculous; consequently my results would confirm Milligan's statement if we modified it by adding to it *in children under five years of age.*

The fact that Bezold's perforation occurred in about 20 % of both my tuberculous and non-tuberculous cases also points to a considerable destruction of bone being present in many cases of non-tuberculous middle-ear disease. In the non-tuberculous cases the Bezold perforation was much later in appearing, after the onset of the ear disease, than in the tuberculous, which shows that destruction of bone is more rapid in tuberculous cases.

Bare bone was felt through the meatus in 40 % of the tuberculous cases, and in 21.4 % of the non-tuberculous cases.

The destruction of bone about the middle ear was chiefly in the mastoid process, and was great in all the tuberculous cases and in 53 % of the non-tuberculous.

The fact that great destruction of bone and hollowing out of the mastoid process are frequent in tuberculous cases, with comparatively slight subjective and objective symptoms, seems due, first, to the painless nature of tuberculous disease generally, and second, to the fact that the mastoid process has a cortical layer of hard bone which resists the

[1] W. Milligan, *Transactions of Sixth International Otological Congress*, 1899, p. 35.

advancing disease for a much longer time than the more vascular and cancellous bone beneath.

Complete perforation of the outer surface of the mastoid process occurred in only one of my cases (Case 7), but in all the tuberculous cases the shell of the bone which covered the diseased bone and granulations beneath was very thin, while in only four of the non-tuberculous was this the case. In four this layer of bone was only slightly thinned, and in two it was thickened and sclerosed. In the remaining three cases the mastoid was not opened.

In all the tuberculous cases the diseased bone about the mastoid cavities was softer than in the non-tuberculous, consequently this symptom affords some indication as to the nature of the disease.

A sequestrum was found in 20 % of the tuberculous cases and in 15 % of the non-tuberculous cases. Of these sequestra it cannot be said that any of them presented distinctive characteristics, excepting microscopically.

Facial paralysis. — Facial paralysis was present in 60 % of the tuberculous cases, and in 33 % of the non-tuberculous, but the onset of the paralysis was at a much earlier stage of the disease in the tuberculous. In two-thirds of the non-tuberculous it was a late symptom, appearing more than a year after the discharge commenced. This shows that facial paralysis is not only more frequent in tuberculous cases, but that when it is present as an early symptom it strongly points to the ear disease being tuberculous.

Ear affected. — In the tuberculous cases the discharge appeared first in the left ear in 60 %, while in 40 % of them the other ear is known to have become tuberculous. In the thirteen non-tuberculous cases the left ear was affected first in 53 %, and suppuration subsequently appeared in the other ear in 26 %. This observation indicates that one ear is first affected about as often as the others, but that the second ear becomes involved more frequently in tuberculous cases.

Duration of the discharge. — The duration of discharge in the tuberculous cases was from ten weeks to two years and nine months; in the non-tuberculous, from four days to many years — in one case thirteen years. Thus the average

duration in the non-tuberculous was much greater, and indicates a worse prognosis in the tuberculous cases.

Pain. — In none of the tuberculous cases did the discharge follow an acute illness, and in 80 % it commenced without any history of pain. In the one tuberculous case (Case 2) in which there was a history of pain preceding the discharge, both ears had been suppurating for more than a year, and during that time the patient had been living in a house with two advanced cases of phthisis, consequently it is conceivable that the tuberculous ear condition may have been a secondary infection and not the primary disease.

In seven, or 53.85 %, of the non-tuberculous cases the onset of discharge was associated with acute pain, and was also associated with an acute illness, — in three cases with measles (6, 13, and 19), in three others with acute catarrh (12, 17, and 19), and in one influenza (14). In one case (11) the onset of discharge was painless, while with regard to the remaining five cases no clear history was obtained on this point. The absence of evidence of pain in the diseased ear was thus a marked symptom in the tuberculous cases, while its presence was frequently observed in the non-tuberculous cases.

Tuberculosis in other organs cannot be said, in my cases, to have shown any reliable indication as to the nature of the ear disease, as it was proved to be present in only one case of each group, and in the one case of doubtful nature.

Enlarged glands near the affected ear were present in all my tuberculous cases, and in only two of my non-tuberculous cases, consequently their presence suggests that the ear disease may be tuberculous, while the presence of a *suppurating sinus* in the same position — especially when pale, flabby, and œdematous granulations are found about its entrance — is strong evidence of the ear disease being tuberculous, for a discharging sinus was present near the ear in 80 % of my tuberculous cases, and in only 7.6 % of my non-tuberculous.

The character of the discharge from the ear was very similar in my tuberculous and non-tuberculous cases, being thick, yellow, creamy, and fœtid. There were two excep-

tions, one a case of cholesteatoma, where the discharge contained solid, cheesy particles, and the other (Case 9), which was of a doubtful nature, consequently this symptom did not produce any evidence in my cases for or against the disease being tuberculous. This is probably due to the fact that at the time the cases were examined the infection had become a mixed one.

Granulations removed by operations from the mastoid are a more important indication of the nature of the ear disease; for in 80 % of my tuberculous cases they were pale, œdematous, and flabby, and in 76.9 % of my non-tuberculous they were dark red in color and not flabby. Caseating points are sometimes met with in tuberculous granulations, *e. g.*, Case 1.

Tympanic membrane. — In so few of my cases was it possible to obtain a satisfactory view of the perforations in the tympanic membrane that no conclusions can be drawn therefrom.

Nature of the infection. — With reference to the question of whether tuberculosis of the middle ear is more frequently a primary or a secondary infection, my observations were unavoidably incomplete; for although no evidence of tuberculosis was discovered in other organs in four of them, tuberculous naso-pharyngeal adenoids were not excluded, and this I believe to be essential before concluding that the disease had its primary focus in the middle ear, since adenoids from their nature and position are particularly liable to infection, and because it has been proved that latent tuberculosis may exist in that tissue for a considerable time. A digital examination of the naso-pharynx ought to be made in all cases of suppurative otitis media, and should any hypertrophied tissue be felt there it should be removed and examined microscopically for tubercle.

In the only one of my tuberculous cases in which the post-mortem examination enabled this point to be cleared up, tuberculous adenoids were present and had passed unobserved during life. When one considers the intimate connection between naso-pharyngeal lymphoid tissue and the similar tissue in the sub-mucous layer of the Eustachian

tube, it is clear that one of these tissues could not long be tuberculous before it would appear in the other. Consequently I contend that following the method above suggested would not only assist in arriving at an early diagnosis, but in cases in which tuberculous adenoids were found their removal would get rid of a focus and breeding ground of this disease (which is specially liable to infect and re-infect the middle ear, and also to infect the lungs and alimentary tract), and would produce a beneficial effect upon the whole future course of the case.

Aural polypi. — No aural polypi were found in any of the tuberculous cases, but they were present in three of the non-tuberculous.

The relation of cholesteatoma to tubercle. — Inoculation experiments proved that the two cases of chronic suppurative otitis complicated by cholesteatoma which I investigated were non-tuberculous, and thus support Scheibe's observations.[1]

Granulation of the operation wound was noticeably slower and feebler in the tuberculous cases than in the non-tuberculous.

CONCLUSIONS.

1. Advanced tuberculous changes may be present in the mucous membrane of the tympanum and of the tympanic membrane itself without producing visible evidence through the external auditory meatus.

2. The membrana propria of the drumhead offers marked resistance to tuberculous infiltration and is only destroyed by a process of erosion. This resistance also accounts for the frequency of multiple perforations in tuberculous cases.

3. Latent tuberculous naso-pharyngeal adenoids and all other latent foci must be excluded before deciding that any case of middle-ear tuberculosis was a primary infection.

4. A high percentage, probably 65–70 %, of cases of suppurative otitis media with neighboring bone lesion, in children under five years, are tuberculous; in older persons, not more than 16 % of similar cases are tuberculous.

[1] ARCHIVES OF OTOLOGY, 1898, p. 133.

5. Intraperitoneal inoculation of guinea-pigs is a good and reliable method of proving the presence or absence of tuberculosis in granulations from the middle ear. Reliable proofs may also be obtained by examining microscopically such granulations or even an enlarged mastoid gland or naso-pharyngeal adenoids when present.

6. In cases of suppurative otitis media, the absence of ear pain, early and extensive destruction of bone, early facial paralysis, multiple perforations, pale flabby granulations with caseous points in the meatus, about a mastoid sinus, and in the mastoid antrum, and an enlarged mastoid gland point strongly to the disease being tuberculous.

7. The detection of bare bone with a probe through the meatus, the character of the discharge, facial paralysis, and extensive destruction of bone appearing as a late symptom are of doubtful value in arriving at a diagnosis, while the presence of cholesteatomatous masses is positively opposed to tubercles being present.

To Drs. P. McBride and D. Noël Paton I am indebted for much valuable advice and direction. To Dr. P. McBride I also wish to express my thanks for the privilege of observing, studying, and reporting Cases 3, 4, 5, 6, 7, 10, 11, 12, 14, 16, 18, and 19. The operations described were done by him.

In like manner I am indebted to Mr. Stiles for Cases 1 and 2, to Dr. MacKenzie Johnston for Cases 8 and 15, to Dr. Hunter MacKenzie for Case 13, and to Dr. Logan Turner for Case 9. To Dr. D. Patrick of Montreal I am under much obligation for his kindness in preparing the micro-photographs.

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REPORT ON THE TRANSACTIONS OF THE SECTION ON OTOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By Dr. JOSEPH KENEFICK.

STATED MEETING HELD APRIL 10, 1902.

James F. McKernon, M.D., in the Chair.

Dr. John Guttman presented a case of **horny degeneration of the lobule of the auricle** in order to get an expression from the Section as to its exact nature. It looked very much like chondroma, but since there is no cartilage in the lobule such a diagnosis was not possible. The growth had lasted about four years. The Doctor had never seen anything like it before.

Dr. T. J. Harris reported the histories of the two following cases :

I.—**Otitis media, acute perforation of tegmen tympani, pachymeningitis, death.**

Our still limited knowledge of brain disease as a result of affections of the middle ear warrants the reporting of these cases, especially as in certain important particulars the classical symptoms were lacking.

B. N., æt. thirty, clerk, with no history of previous ear trouble, was seized with severe pain in left ear on the morning of March 11th. He at once consulted his family physician, who performed a paracentesis memb. tympani, and ordered hot douching.

The day following, as there was no diminution in the pain, he sent for me. I saw the case at eight o'clock that night, thirty-six hours after the onset of the attack. The patient was a strongly built man of thirty. There was no suggestion of any neurotic element. He seemed to be in much suffering, saying he must have relief. The temperature was normal. Examination of ear showed

a generally reddened drum, with slight prominence of posterior segment. Patient stated that there had been a rather free discharge of pus during the day. The incision of the former paracentesis was not visible ; there was no tenderness over the mastoid except in a slight degree at the tip. The patient was advised to enter a hospital, and was admitted to the Post-Graduate Hospital that night, where a free internal Wilde incision was made under primary ether anæsthesia, at ten o'clock. There was no free escape of pus, though the hospital records mention a small amount. The hot douching was ordered continued hourly. The next day there was no alleviation of the pain. This was referred directly to the ear, and never to the mastoid, a symptom which was unchanged during the entire course of the disease. The temperature remained normal, 98.2°, mind perfectly clear, no suggestion of brain trouble. Examination of ear showed no bulging of membrane. With the idea that there might be some gathering of pus to account for the continued pain, the paracentesis was repeated. This time cocain alone was used. Morphine as high as three-fourths of a grain, hypodermically only, slightly relieved the pain. An ice-coil was ordered to the mastoid.

The following day, Thursday, the temperature was 99.4°, pulse 68 ; condition unchanged ; no development of mastoid symptoms. Hot douching and ice-coil continued. Friday, the fifth day of disease, pain in ear was slightly less, but tenderness on deep pressure over mastoid antrum more marked ; temperature 102°, pulse 80.

On account of the persistence of the pain and the temperature, it was decided to open the mastoid, which was done that afternoon. The bone was found entirely healthy, the antrum was abnormally far forward, and on account of the entire absence of disease was not opened. In the course of the operation the inner plate of the mastoid was penetrated, and an escape of cerebrospinal fluid from the middle cerebral fossa took place. Time of operation, forty-five minutes. The day following, the patient was feeling slightly easier. Pain did not abate much ; temperature 90.2°, pulse 75. But on Sunday, the 17th, his temperature went up to 104° – 106°, pulse 75.

In consultation with Dr. James F. McKernon, it was decided to establish drainage with the middle ear by opening the mastoid antrum, it being feared that there was some retention of pus there. This was done at 2 P.M., assisted by Dr. McKernon. The middle

fossa of the skull and the lateral sinus were thoroughly exposed and found in good condition; the mastoid antrum also was free from pus or diseased bone. There was no bulging of the dura. The patient stood the operation well, but did not improve. During the day twitching of the facial muscles was noticed, later pupil of the right eye dilated, together with a ptosis of the right eyelid. At 7.30 P.M., Cheyne-Stokes respiration, temperature 106°, pulse 92. It was decided to explore the cranial cavity. At 11.30 the patient was again anæsthetized, and the original incision carried upward and forward over the temporo-sphenoidal lobe; a large button of bone was removed, the dura incised, and a careful exploration of the brain substance made by means of a long bistoury. An area of softened disintegrated cerebral material was discovered above the attic, but no pus. The wound was dressed with sterile gauze.

The patient did not come out of his delirium, and died, the second day following, in coma. An autopsy on the head was obtained, and revealed a perforation of the tegmen tympani. A blood clot was found in the temporo-sphenoidal lobe, surrounded by an area of softened tissue about one-eighth to one-fourth of an inch in diameter; no pus.

It was not permitted to remove the skull-cap, so the condition of the deeper parts could not be ascertained.

II.—**Thrombosis of lateral sinus without manifest mastoid involvement. Operation including ligation of jugular vein. Recovery.**

W. G., age twenty-one, was admitted to the Manhattan Eye and Ear Hospital, April 3, 1901, with the following history: For twelve days previous he had been suffering from pain in the left ear, with slight discharge; eight days ago experienced difficulty in mastication, and cheek became swollen; pain in the ear extended to the whole side of the face.

Note on admission.—Temperature, 98.2°; pulse, 80; respiration, 20; slight pain in ear; no tenderness or pain over mastoid antrum or tip. Examination of ear showed no bulging of drum membrane, but an old perforation in anterior segment. There was considerable swelling of the glands extending into the neck; opening of the mouth caused pain; there was a slight discharge from the ear; tongue coated. Hot douche was ordered to the ear hourly, ice-coil for the swelling over neck. Patient was a

strong, muscular fellow with no history of previous illness, and showed, when seen the next day, no evidence of serious sickness. In the course of forty-eight hours the swelling in neck had disappeared, but the patient began to complain of pain in the head; this was present over the temporo-sphenoidal lobe of the left side for a short time, but soon became localized over the frontal lobe; the temperature remained fairly normal until about the sixth day, when it began to show considerable variation, until on the seventh it rose to 105°. At no time while in the hospital did the patient have any distinct chill or even chilly sensation. No tenderness at any time was apparent over the mastoid.

On April 8th, it was decided, because of the two symptoms, persistent cephalalgia and elevated temperature, to operate. The usual mastoid operation was first performed, and the mastoid antrum thoroughly opened; no pus or other disease was discovered in the mastoid cells—at the most, a doubtful softening of the bone in one or two areas. The lateral sinus was then exposed. In the sigmoid groove at the knee it presented an unhealthy appearance, but pulsation was distinctly present. After a careful disinfection with sterilized water and alcohol, the sinus was aspirated; nothing flowed. The wall was then carefully incised posteriorly, and a thrombus was found extending back as far as the torcular and downward to the bulb. After still further incising the wall of the sinus, this was carefully removed with the blunt curette. No marked flow of blood followed the removal from the torcular, and only a partial flow from the bulb. The sinus was then very gently irrigated with sterilized water and packed with iodoform gauze. The patient did well for the first week after the operation, but did not have an entirely afebrile temperature. The thrombus appeared to be a healthy one. The general condition of the patient was fairly satisfactory, but showed something of a septic nature. About April 18th, however, six days after the operation, he did not seem so well; and in spite of the healthy appearance of the sinus wound fear began to be entertained that further infection was proceeding from the jugular vein. Accordingly, upon April 22d, the patient was again anæsthetized, and the jugular vein was opened in the usual manner. There was a slight blood-current passing through, but this was decided to be proceeding from the facial vein. (The vein was accordingly ligated in this situation and removed.)

Wound closed, and the patient returned to the ward. For the

first few days after the operation his condition was profoundly septic; pneumonia, limited in area, was discovered. Gradually, however, by the liberal use of stimulants, especially strychnine and nitro-glycerine, used at first hypodermically, his condition began to improve, until he went on to recovery, and was discharged from the hospital, May 12, 1901.

These cases present several points of unusual interest.

Case 1 is peculiar, in my own experience at least, for the acuteness and intensity of the symptoms and the early communication of infection to the brain through the tegmen tympani. It will be noticed that early paracentesis of the drum was performed, and that without marked bulging, and further that no involvement of the mastoid cells was at any time discoverable.

In the light of our present knowledge, any procedure other than those that were adopted does not seem possible. The condition was a rare one, and the only symptom peculiar to it was intense localized pain in ear, without signs of pus retention in tympanic cavity. The pus unfortunately was not examined, and its virulency accordingly not ascertained.

Case 2, who is presented to-night for your inspection, also offers several points of interest. Of these, the most important was the entire absence of all pain or tenderness over the mastoid and the absence of all chill while under observation. This is unusual in the extreme, and yet, as Dr. McKernon has rightly said, we do not need to look for a chill. The history of chilly sensation will be sufficient in a given case; and, further, the chill may have occurred before patient entered hospital. Finally, the important question is suggested of the advisability of exposing the jugular vein. At the time of operation in our own case, there seemed to be no special indication for so doing, and yet undoubtedly the patient was in better condition for the operation at that time than later, and would have been saved, in all probability, the subsequent septic absorption.

Dr. Thomas R. Pooley had recently seen a case in consultation with Dr. S. Beach Jones, of this city. Dr. Janeway had also been associated in the treatment of the case. About two weeks ago he saw the patient between nine and ten o'clock at night, suffering from pneumonia. The history he gave was that his illness began with grippe, which was soon followed by an acute inflammation of the middle ear of the left side with perforation of the drumhead and a copious discharge of a sanguinolent fluid.

He came under the physician's care because of pneumonia. Dr. Janeway saw the case several times in consultation, and the question was raised whether or not there might not be a sinus thrombosis; it was a very difficult matter to decide, for the conditions were these: The patient was in a semi-comatose condition, and therefore it was impossible to elicit any information as to the tenderness over the mastoid region; there was no redness, œdema, or swelling; there was no induration in the course of the jugular vein or any of its emissaries; examination of the membrana tympani showed a perforation in the inferior-anterior quadrant, and the discharge had never become purulent. The special point of interest in this case was in reference to the temperature chart, because in such conditions one naturally expected to establish a diagnosis of thrombosis of the sinus from the history of the temperature. There had been only one initial chill, which was supposed to mark the beginning of the pneumonia. The temperature had never been above 103°; there had been no rapid rise and fall such as would characterize thrombosis and sepsis. He was relieved from any embarrassment incident to the failure in making a diagnosis by the death of the patient the following morning.

The Doctor was quite in accord with what had been stated as to the absence of an extreme rise and fall of temperature in cases of sinus disease in some cases, and he had found no literature which emphasized that point which was such a remarkable feature in the report of the cases. He said that we must all think of the pneumonia as being of possible septic origin, caused by sinus thrombosis, in all such cases where ear disease existed.

Dr. WENDELL C. PHILLIPS said that he had been present at both operations upon this patient, and he was very much impressed by the absence of one of our so-called classical symptoms of mastoid disease—the entire absence of tenderness. During the several days that the patient had been under observation, there had been no time when there could be elicited the slightest degree of tenderness over any portion of the cortex, and it was only because there were present the suppuration and the other symptoms already described that had led to operative interference. If he remembered correctly, he expressed himself at the time as being extremely doubtful whether there was much disease there. Finally the symptoms became so marked and pronounced that it was decided to operate and locate the pus. Another point of interest was in reference to the internal jugular vein; there was but

little difficulty in tracing it upwards until the last branch had been tied; from that point there was nothing to be noted except a cord.

The case was to him of special interest because it did not give all the symptoms which should accompany sinus thrombosis.

In reference to the second case, it simply emphasized the fact of our utter helplessness in cases of lepto-meningitis.

Dr. FRANCIS J. QUINLAN said he was especially interested in the report of the last case, because he had recently seen in his service at the City Hospital an identical one with the same objective and subjective symptoms. The patient was a woman who had an acute middle-ear trouble for two or three days, and complained of lancinating pain over the mastoid and auricle. Examination showed the sagging of the posterior-superior part of the canal, as well as a deep bulging and congestion of Shrapnell's membrane. A free incision was made in the drumhead and posterior canal wall to get good drainage as speedily as possible; two or three drops of pus followed this flap-incision, and the woman felt comfortable during that night and until four o'clock the day following, when the pain returned. The temperature chart showed a rise of a degree and a half; then it went down, and again, at the end of two or three days, it rose to 104°. The patient became very irritable, indifferent to surroundings, sank into stupor from which she could be aroused, but took little interest in things about her. Lumbar puncture was made, I think, and a serous fluid obtained; meningitis was excluded. Drs. Brewer and Hammond made the diagnosis of brain abscess, and at their suggestion I opened the mastoid, and found absolutely nothing to give evidence of caries or necrosis. The tympanic cells were clean; no pus was found in the antrum; nothing present but what showed an apparent normal condition. It was then decided to explore the temporo-sphenoidal lobe, which was done by extending incision 1½ inches upwards; the dura was found to be mottled and bulging. A free incision was made into the temporo-sphenoidal lobe and it was explored for a distance of 1½ inches, but no pus was found. Drs. Hammond and Brewer, who were present at the operation, both believed that an abscess was present, although it was not located.

Dr. GEORGE L. RICHARDS, of Fall River, Mass., contributed a paper entitled **chronic suppurative otitis media: When should radical surgery be employed in its treatment, and of what**

should this consist? He said that nearly every case improved under treatment, and even may dry up for a time, but that it was almost sure to start up again; he therefore believed it to be the aurist's duty, after a reasonable time, to place before his patient the question of a radical operation, stating the possible dangers incident to a suppurative ear, and explaining that although no serious complications may result, yet the danger is always present, and when that danger comes there may be no warning. Hearing, he stated, was improved by the operative procedures, because material which was a hindrance to the passage of sound waves was removed. He believed the time was not far distant when otologists would urge upon their patients the desirability and need of thorough cure. The question of operation resolved itself into two methods: First, that of clearing out the contents of the tympanic cavity through the external canal, known as ossiculectomy; and second, the so-called radical operation, with its various modifications. The operation of choice should be the one which allows of healing taking place from the bottom of the diseased cavity and provides for free drainage during the healing process. The operation of ossiculectomy had the advantage that it can be done through the external canal, requires no external wound, has but a short deprivation of work, etc. Among the disadvantages are: the attic is not visible, the curettage is mostly done in the dark, and one can never be sure that all the disease has been removed. The radical operation consisted, he said, in the throwing of the cavities of the middle ear, the attic, and the antrum into one, with the removal, as far as possible, of all carious or diseased bone, and of the ossicles with the exception of the stapes. There were two methods of performing the radical operation, that of Stacke and that of Zaufal. Dr. Richard's cases only remained in the hospital twelve days, and were back to work about three weeks from the time of operation. No troublesome symptoms followed. Three of his patients had complained solely of long-standing suppurative otorrhœa; these cases were finally cured over periods varying from five weeks to three months. The hearing and the general health improved in each case. His fourth case was that of a boy who had suffered from a chronic discharge from each ear, with diffuse mastoiditis on the left side. After three attempts to cure by Schwartze's method, he did the radical operation, which was followed by cessation of the discharge. The fifth case was one where acute symptoms supervened on an old

otorrhœa; in this instance he did a plastic operation after the manner of Koerner, which was followed by good results.

In spite of the fact that many otologists still believe in the palliative treatment of chronic suppurative otitis, and although Koerner stated that he saw brain symptoms occur only twice in 2207 such patients, and that he did not fear the threatening brain symptoms to such a degree as to acknowledge the Stacke operation to be a prophylactic measure, and in spite of the fact that cases in which the indication for the radical operation as stated by Stacke was present are sometimes cured without operation, Dr. Richards nevertheless believed, in view of his experience at home and abroad, and in view of the many reported cases of serious brain and sinus trouble which were constantly being brought to our attention in otological and general medical literature, that it was our duty in all cases of suppurative otitis media which were not cured within a reasonable length of time, to urge upon the patient the need of more radical surgery for the removal of the entire diseased area and the promotion so far as possible of a positive cure.

Dr. EDWARD B. DENCH said that it gave him great pleasure to open the discussion on this paper, because he thought that the statements made by the reader of the article were in accord with the sentiments of all present. For a number of years he had been inclined to take the view mentioned by the Doctor in the early part of the paper—that is, that a large proportion of cases of suppurative otitis media could be permanently cured by measures less severe than the radical operation. By this he meant that many cases of chronic purulent otitis media could be permanently relieved by the simple removal of the ossicles and the thorough curettement of the tympanic walls. Later experience had taught him, however, that many of the cases operated upon in this way, and in which a permanent cure seemed to have been established, required later a second operation, owing to a recurrence of the otorrhœa. In a number of these cases he had found it necessary, after a lapse of several years, to perform a radical operation in order to relieve the discharge from the ear. For this reason he thought that the paper was very appropriate and timely. Many of those present were still doing the simpler operations, and undoubtedly they were now becoming dissatisfied with their results.

Upon one or two points mentioned in the paper he could not

take the same view as that taken by the reader. This was especially true concerning those remarks which referred to the hearing of the patients after a radical operation. He was certain that the results, especially with regard to the power of audition, were not as good as after a simple removal of the ossicles. Concerning the advantages of the radical procedure in affording a clearer operative field, it has been his experience that although the operative field was wider, the view of the deeper parts was hardly as clear as when the simpler operation was performed through the external auditory meatus. In doing the radical operation there must necessarily be considerable oozing from the divided structures. This hemorrhage certainly obscured the deeper parts and rendered the manipulations of the surgeon less exact than where the operation was performed through the external auditory canal. This was especially true in cases where the external auditory meatus is unusually long and narrow, and where the antrum is small and the mastoid process sclerosed. In such cases the field of operation in the radical procedure is exceedingly narrow. If this field is extended by the removal of perfectly healthy bone, the bleeding from this osseous surface is considerable; important landmarks must be removed, and the operation is conducted with much less certainty than in those cases where it is carried on through the external auditory meatus, with the normal landmarks in position. It is almost impossible to get a very wide field of operation without imperilling important structures, such as the dura and lateral sinus. The hemorrhage, which must necessarily attend any radical operation, must of necessity obscure the field of vision, and in many cases this hemorrhage so obscures the parts as to more than compensate for the increased operative field.

He was still of the belief that where the disease was limited to the ossicles and the external wall of the attic, with, perhaps, the involvement of a small portion of the roof of the tympanic cavity, and where the parts were easily accessible through the external auditory meatus, the simple operation of removal of the ossicles with curettement of the tympanic cavity through the canal, was still the operation of election. He was impressed with one point brought out by the reader of the paper, and that was that we should tell our patients when about to perform the simpler operation, that at some future time it might be necessary to adopt the more radical procedure. In other words, the patient should

understand that the simple removal of the ossicles was merely an intent on the part of the surgeon to avoid the graver operation; but that this latter procedure might at some time become necessary. He believed in all cases where suppuration was profuse or where there was a cholesteatoma present that, as a rule, the radical operation should be done. He mentioned, however, that in a few cases which had come under his observation where a cholesteatomatous deposit was limited to the tympanic vault, a complete cure had been effected by the simpler operation. In all cases, however, in which extensive destruction of the intratympanic structures had taken place, with widespread involvement of the tympanic walls and extension to the mastoid cells, with or without the presence of extensive cholesteatomatous deposits, he believed that the radical operation was the only procedure which promised the patient permanent relief.

He was interested in hearing the Doctor describe the various methods of forming the flaps in performing the radical operation. He had recently modified his operation in one case, and instead of splitting the canal horizontally along its posterior aspect and then making an incision at right angles to this horizontal incision, so as to form quadrilateral flaps, he had split the canal along its superior aspect, well out into the concha, and from the outer extremity of this incision, had made a vertical incision downward through the concha to the inferior walls of the meatus, thus forming one broad uniform flap. By removing the conchal cartilage from the outer extremity of this flap, a skin flap had been formed, which applied itself perfectly to the floor of the bony cavity and covered completely the spur of the posterior wall and facial ridge. Epidermization had occurred very rapidly in this case. He believed that the manner of forming the flaps must vary with each individual case. He frequently made a tongue-shaped flap comprising the entire cutaneous lining of the concha, the cartilage being dissected out completely. This flap was then drawn upward and backward and sutured to the corresponding raw surface in the posterior wound. The flap was sutured by means of catgut sutures, which would be absorbed in the course of four or five days. The procedure differed in this regard, from that of Ballance, in which a flap, formed in a similar manner, was brought in apposition with the corresponding raw surface above by means of retention sutures passed through the healthy skin. This particular flap operation was applicable to certain cases.

Regarding skin grafting by the Thiersch method in those cases, he said that he had only employed the procedure in one instance. In this case, it had not been necessary to open the posterior wound in order to apply the grafts to the middle ear, as, owing to the enlarged meatus which resulted from the radical operation, it was entirely possible to apply these grafts to the walls of the bony cavity, including the internal wall of the middle ear, directly through the external auditory canal without reopening the posterior wound. The result in this case had been perfectly satisfactory and epidermization had occurred rapidly.

Dr. ROBERT C. MYLES said we were indebted to Dr. Richards for his timely paper and he was very grateful for the opportunity of hearing it because the literature did not give all the information wanted. The problems presented by different cases are not alike and otologists were all wishing for some method by which a permanent and complete cure could be obtained. He had tried the removal of the membrana tympani with the ossicles and then had to resort to the radical operation. His most grateful patients to-day were those upon whom he had done this operation. In his operations upon cadavers he had noticed the frequency with which chronic disease in the mastoid cells was found; it was quite common to find large polypi in the cells, or the cells full of pus, in those who were brought to the morgue. In these cases he believed there were two sources of danger: (1) from a gradual necrosis of the bone which extended to the tegmen tympani, or through the lateral sinus; (2) from sepsis transmitted either through the veins, the lymphatics, or other channels. Such dangers may arise at any time. Many patients refuse to have more done than splitting the drum and pouring alcohol in, and they get well; often with these cases it is only a question of drainage. But the important points that struck him were as follows: First, the damage that was likely to follow when the chisel, mallet, and other instruments were used, on account of the variations in the anatomy; second, when the chisel and mallet were used before enough time was taken to permit the flow of blood to subside; if these points were more often noted he did not think there would follow so many evil consequences to the facial nerve or the cranial cavity.

A point that he had never been able to find in any literature related to the detailed daily after-treatment of these cases, which aimed at the cleansing of certain crevices, or pockets, where pus

continued to be formed. In some patients that he had operated upon for local physicians there were present pockets and, after three or four months, these patients came back with the discharge of pus continuing. He thought these daily details of the after treatment were very interesting and should be more carefully considered.

Dr. JAMES F. MCKERNON said he was very much gratified to have heard the paper read and particularly to have heard the Doctor say that a guarded prognosis, both when operating through the canal and also in doing the posterior operation, should be given; he believed that such a guarded prognosis should always be given and it would save us much unpleasantness which might come up later. He also advised informing the patient of the dangers which might result from long-continued suppuration; every patient, whether a child or adult, should be informed of these dangers from pus infection and the intracranial complications which may follow.

He had done the operations referred to and, during the past two years, he had been doing a combination operation, *i. e.*, a partial Stacke operation, first going into the mastoid antrum and clearing out and making complete drainage between the mastoid antrum and the middle ear, and then removing the under surface of the posterior wall and angle, chiselling in from above, removing the entire under surface of the posterior wall, and enlarging the opening sufficiently to go in and remove all the diseased tissue. He had done nine such cases, two within the past three months. The others were entirely healed and no suppuration followed subsequently. Such a procedure did not force the surgeon to do a flap operation. The posterior opening was closed by granulation tissue, which necessitated drainage. In none of his cases had he ever observed any ill results following; in case such ill results should occur in the future he would report them to the Section.

Dr. WENDELL C. PHILLIPS, after congratulating Dr. Richards upon the paper, made a few remarks which related particularly to his own experience. He said it was a constant source of surprise to him to have so many patients state that they never had had any treatment for the chronic suppuration of the middle ear, and others who have had treatment which has been of such a nature that the patients were made worse rather than better. He therefore believed that Dr. Richards had taken the proper ground when he stated that we should use the palliative treatment only for a reasonable length of time. He believed that we were losing

a great deal of time in chronic suppurations by too much delay and by other attempts than radical treatment. It was his habit to say to such patients that local treatment may not be successful and that it may be necessary to resort to operative interference. He believed that if the operator thoroughly understood his anatomy the radical operation could safely be attempted. He was inclined to perform the Stacke operation without any modifications, unless convinced that the mastoid cells were involved. The Stacke-Schwartze operation he thought was indicated in a large proportion of the cases, but not where the extension of the disease had not gone on beyond the antrum of the mastoid bone. A few years ago he had an experience which he thought might be interesting. A man who was an officer of a large life-insurance company came to him and said he never realized what it meant to ask for a life insurance when there was present a discharge from the ear. He was refused because he had at times a slight discharge from the middle ear. He had asked the examiner: "How long must an applicant be free from discharge before he would be accepted?" He replied that the rule was that the applicant should go three years without any manifestations of suppuration before he would be accepted by the life-insurance company. Thus it became an important matter from a life-insurance standpoint.

In his experience as a teacher, he made it a point always to say, in connection with the treatment of suppurations of the middle ear, that there would never be such a thing as chronic suppuration of the middle ear provided the patients could be properly treated during the acute stages, and he shows his students how to treat such cases.

Dr. WILLIAM H. BATES said that in cases of chronic suppuration of the middle ear it would be better for us to say to the patient: "If you have a radical operation done you will be more apt to be cured than if the simpler operations should be performed." He had the pleasure of showing the members of the Section some eight years ago a number of cases in which he had performed the Stacke-Schwartze operation; at that time he was very well pleased with it, and he was still well pleased with it, and he did it whenever the occasion presented itself. He did not mean to say that he always cured the discharge by this operation, because while one removed a great deal of dead bone, or the source of the infection, the Stacke-Schwartze operation did not invariably do it.

Only to-day he saw a patient upon whom he had performed this operation five years ago, and while he had operated thoroughly, the discharge kept up pretty much the same. It was his practice to say to his patient that if the Stacke-Schwartze operation be done you will be less apt to have serious trouble later. He did not feel enough confidence in it to guarantee any patient certainty of cure.

Dr. MAX TOEPLITZ said that he would like to state that there were several cases in which the radical operation had been performed without curing the suppuration, as Dr. Bates had already mentioned, and he mentioned another important point which should be considered, *i. e.*, suppuration occurring in the labyrinth, due in one of his cases to injury of the labyrinth during the operation; in another of his cases the labyrinth was injured through disease. In chronic cases we often find involvement of the labyrinth with tuberculosis, and cholesteatoma in acute cases from scarlet fever. Many times in labyrinthine suppuration the symptoms are latent, and it is very difficult to make a diagnosis of the condition. In operating, he said, it was often very difficult to expose the labyrinth so as to make an examination of the parts and therefore it was necessary to take away the anterior wall of the mastoid as much as possible, and also to remove the upper portion of the external meatus thoroughly, so as to expose the labyrinth in its entire extent. He thought that all were fully aware that Jansen operated upon such cases through the labyrinth, a procedure by no means very easy, and not without danger. In those cases where there is a fistulous tract in the horizontal semicircular canal the fistula can easily be reached; but where the fistula is in the promontory it is far more difficult to get at. To enter the cochlea and labyrinth from the promontory is very dangerous, because the carotid canal may encroach upon it and be in danger of being opened. If you enter the labyrinth from the oval window, it will be difficult to avoid the facial nerve which runs above it. He thought the most rational procedure would be to cut from the inner wall of the mastoid into the horizontal semicircular canal, from which the vestibule is entered and the labyrinth cleaned out. He believed this to be very important, because in his cases, one in which the suppuration had lasted thirty-five years, the after-treatment had been prolonged for six months; after the elimination of the sequestra, cure followed. He emphasized the importance of looking to the condition of the labyrinth.

Dr. GEORGE L. RICHARDS, in closing the discussion, said that one, of course, could never be absolutely sure that all diseased bone had been removed. He always told his patients that he operated because of the presence of disease, which he removed as thoroughly as possible, but could not be held responsible for any future progress of the disease in the bone. He also tells the patients: "Almost eighty per cent. of brain abscesses come from chronic otitis media; can you afford to take such risks? Life-insurance companies will not take you at the present time. The operation is practically devoid of serious risk. The chances of cure are good. There is no external scar. The after-treatment requires about six weeks, and this will not cause you any particular annoyance." He said that such a statement appealed to them, and made them believe that it was better to submit to the more radical operation which offered presumptively the probability of a permanent cure.

With reference to the blood in the cavity at the time of operation, of course that was a source of great annoyance. This operation is largely done in that class of cases in which the bone is very hard and chiselling is not easy; therefore, he did not follow any rule in operating, although he preferred the Zaufal operation, because it seemed to give him more room in which to work.

REPORT ON THE PROGRESS OF OTOLOGY IN THE FOURTH QUARTER OF THE YEAR 1901.

By Dr. A. HARTMANN.

Translated by Dr. Arnold Knapp.

ANATOMY AND PHYSIOLOGY.

247. **Ichila Kishi.** On the peripheric course and termination of the cochlear nerve. Dissertation, Halle, 1901. *Arch. für mikroskopische Anatomie und Entwicklungsgesch.*, vol. lix., 1901.

248. **Röthig** and **Brugsch.** The development of the labyrinth in the chick. *Arch. f. mikroskopische Anatomie u. Entwicklungsgesch.*, vol. lix., 1901.

249. **Alexander** and **Kreidl.** Anatomical and physiological studies on the labyrinth of the dancing mouse: II. and III. Communications. *Pflüger's Archiv*, vol. lxxxviii., pp. 509, 564.

250. **Robert Keller.** On the results of injuries in the region of the lower olive in the cat. *Arch. f. Anatomie u. Physiologie*, p. 177, 1901.

251. **Marage.** Some remarks on the otoliths in the frog. *Arch. internat. d'otologie*, etc., vol. xiv., No. 5.

252. **Strohmayer.** Anatomical examination of the hearing sphere in man. *Monat. f. Psychiatrie u. Neurologie*, 1901.

253. **Lucae.** The otostroboscope and its physiological importance. *Arch. f. Ohrenheilk.*, vol. liii., p. 39.

247. The author has studied the histology of the membranous spiral lamina in rabbits and dogs and has critically reviewed the divergent opinions of others upon this subject. Three points were especially investigated: 1. In regard to the structure of the cellular group which is situated in Corti's organ median to the inner pillar. 2. The course of the cochlear nerve between the habenula perforata and the sensory cells. 3. The communications between the terminal fibres and the hair cells. In the cells in the epithelial triangle internal to the inner pillar, the author

distinguishes between the internal hair cells and the non-specific epithelial cell, two kinds of typically formed cells, of which one is round and connected with the nerve. Agreeing with Waldeyer and Gottstein, the author regards these cells as analogous to the subepithelial ganglia of the inner granular layer of the retina. The termination of the nerves in the cells takes place as follows: According to the author's staining method, a new structure appears directly underneath the nuclei of the hair cells; it is somewhat goblet-shaped, stains deeply, and is distinctly separated from the surrounding tissue. With the high power it appears granular. This structure embraces also part of the hair-cell. Continuous with the apex of this structure is a fine thread, which is occasionally seen to be distinctly continuous with the external spiral nerve. The staining method, hæmatin, must be referred to in the original and the results require confirmation. ESCHWEILER.

248. The authors have followed Born's method and have constructed a very instructive model, showing the embryonal stages in the development of the labyrinth of the chick from the age of sixty hours to eleven days. As soon as the auditory vesicle has become closed, it still remains connected with the ectoderm for some time by a solid epithelial band which later disappears entirely; it does not aid in the formation of the recessus endolymphaticus. The intricate changes in position which the labyrinth and especially the semicircular canals undergo in development are beautifully shown in this model. ESCHWEILER.

249. The anatomical examinations were made on four dancing mice, one albino mouse, and four gray domestic mice. Of the dancing mice, three had previously been examined from a physiological standpoint. The labyrinths and cerebral peduncles were cut in serial sections and the results were controlled by a series of specimens from normal mice. The results are as follows: 1. In the dancing mice there is a destruction of the macula sacculi. 2. Destruction of the papilla basilaris cochlea with extension to the surrounding tissues of a varying grade. 3. Diminution of the branches and roots of the superior and middle branches of the eighth nerve. 4. A high-grade diminution of the inferior branch of this same nerve. 5. Moderate diminution of both vestibular ganglia showing diminution in the number of their nerve cells. 6. Marked atrophy of the spiral ganglia.

In the physiological part the anatomical results are compared with the results from the physiological examination. In conclu-

sion certain deductions are made on the function of each part of the labyrinth in vertebrates and in man. Without doubt in the case of the dancing mouse the changes are congenital, consequently a case of congenital deafness in man can only be compared to them.

The third communication treats of the physiology of the newly born dancing mouse. In the young, all of the morbid symptoms of the adult mice are already present, as well as the absence of all rotatory vertigo, movement in curves, clumsiness in a narrow path, etc. It is, without doubt, a congenital peculiarity.

DREYFUSS.

250. This paper is reported because crossed fibres from the olive run to the cerebellum and end in the superior worm of the cerebellum, and injuries occurring in the latter region produce symptoms somewhat similar to those associated with labyrinth traumatisms. An injury to the inferior olive, however, is not followed by any manifest disturbance of motility or equilibrium ; in other words, the olivo-cerebellar fibres have nothing to do with the function of equilibrium. DREYFUSS.

251. The content of the inner ear of the frog consists of a solution of potassium and magnesium and their crystals. Possibly through the density of this fluid favorable opportunities for the conduction of sound are present. The function of the otoliths consists in keeping the sound transmission of this medium as nearly constant as possible. SCHWENDT.

252. STROHMAYER has endeavored, with the aid of systematic microscopical examinations of the temporal cortex, to find the central end-station of the auditory nerve. The material came from the brain of a woman of sixty-three years, a congenital deaf-mute who died from a heart lesion. The cause of the auditory defect seemed to be due to a bilateral defect of the cochlear nerve. In addition, both first temporal convolutions were small, both islands were abnormal, and the posterior quadrigeminal bodies were small. The microscopical examination of the cortex confirmed the supposition that the hearing sphere is situated in the first temporal convolution. The relation of the second temporal convolution to the act of hearing is not a direct but an associated one. The distinct localization of the hearing centre is not possible, as the terminations of the cochlear nerves extend in a most unlimited manner into this convolution. The hearing elements of the temporal cortex are probably to be located in the fourth cortical

layer of the "Hammerberg." The condition of the peripheric auditory organ is, unfortunately, not given. Should it not be said that this is a case of defect of the auditory nerve rather than of the acoustic nerve? The defect is not further described.

BRÜHL.

253. LUCAE is of the opinion that for diagnostic purposes it is not sufficient to determine whether the drum membrane and the malleus are mobile or whether they are able to carry out a great number of vibrations which the sound-conducting apparatus has to deal with in receiving sound. As the human eye is not able to follow the extraordinarily rapid vibrations of the drum membrane, the author has employed the otostroboscope method, which apparently retards the vibrations of the drum membrane so that they become visible. The otostroboscope consists of an ordinary reflector to which a rotating disc with ten holes is applied, permitting an intermittent observation of the vibrations of the drum membrane. The spaces between the openings must be so broad that they will completely cover the mirror opening in their rotation. In the anatomically normal drum membrane the most extensive vibrations take place in the upper and posterior quadrants, as well in the slow as in the rapid vibrations up to one thousand in a minute. In one case of definite sclerosis of the normal drum-membrane, vibrations which had been invisible were made apparent with this instrument. In another patient with hereditary deafness no vibrations were visible with the instrument. In a case of diplacusis which can only be the result of labyrinthine affection, fifteen hundred vibrations were detected in the drum membrane in their various phases by this aid of the otostroboscope. It is not possible from the mobility of the hammer to state what may be the function of the other ossicles. DENKER.

GENERAL.

a.— GENERAL SYMPTOMATOLOGY AND PATHOLOGY.

254. **Jürgens.** On the importance of the lymphatic glands surrounding the ear. *St. Petersburg Med. Jour.*, 1901, No. 41.

255. **Genta.** On tinnitus due to increased arterial tension. *Archivio Italiano di Otologia, Rhinologia e Laryngologia*, second year, No. 3.

256. **Zeroni.** On involvement of the temporal bone in acute osteomyelitis. *Arch. f. Ohrenheilk.*, vol. liii., p. 315.

257. **Lewin.** On the clinical and pathological condition of the auditory organ in genuine diphtheria (continued). *Arch. f. Ohrenheilk.*, vol. liii., p. 1.

258. **Habermann, J.** On the pathology of deaf-mutism and of the oval window. *Arch. f. Ohrenheilk.*, vol. liii., p. 52.

254. After describing the anatomy of the surrounding lymph glands, the author draws attention to the possibility of an inflamed gland, situated on the tip of the mastoid process or near there, being mistaken for mastoiditis, as it may produce the two important symptoms of mastoiditis — fever and tenderness of the mastoid process. SACHER.

255. GENTA describes that particular form of tinnitus which occurs in cases with an absolutely negative otoscopic and functional condition, appearing at first irregularly and later continuously, and characterized by a sibilant sound or a faint chirping. The electrical reaction of the auditory nerve is increased and occasionally there is slight diminution of perception for high tones. The author thinks this noise is to be distinguished from those which are synchronous with the contraction of a sound or diseased heart muscle. This tinnitus is due to circulatory disturbances in the labyrinth following contraction of the smaller vessels and anæmia of the labyrinth. Genta draws attention to the importance of this tinnitus which accompanies the beginning of increased arterial tension, and may sometimes be the only symptom of commencing arterial disease. RIMINI.

256. In a case of osteomyelitis in a boy thirteen years old, the author observed a purulent discharge from the auditory canal with an intact drum-membrane. The discharge emanated from a defect in the upper bony auditory canal as large as a pea. Post-mortem examination of the temporal bone showed that all the nutritive channels of the bone were unchanged. Spaces in the bone of the upper auditory canal were completely filled with leucocytes varying in size and shape of nuclei. This was consequently not a disease of the bone but an affection of the mucous membrane of the mastoid process without manifest inflammation of the tympanum. The author believes the disease was due to hæmatogenous infection, and thinks that a diagnosis of osteomyelitis of the temporal bone should be made with hesitancy, even if a general osteomyelitis be present and a focus appear in the temporal bone without preceding involvement of the tympanum. DENKER.

257. After describing the changes found in the Eustachian tube and drum membrane, tympanum, labyrinth, external auditory meatus, auditory nerve, and facial canal, the following conclusions

are drawn: Pharyngeal diphtheria does not produce the very severe complications which have been ascribed to it and may even be classed amongst those infectious diseases which are more or less favorable to the ear. In most diphtheritic otitides we have to deal in a pathological sense with an ordinary middle-ear inflammation. The extremely rare cases of true middle-ear diphtheria cause much more severe clinical symptoms and show more extensive anatomical changes than the ordinary middle-ear inflammations in ordinary pharyngeal diphtheria. Though the inner ear is in most cases normal the auditory nerve was found to be most frequently and most severely affected, particularly the hearing organ, so that not uncommonly extensive functional disturbances find their explanation in genuine diphtheria. The diphtheria otitides are usually the result of local manifestation of the diphtheria poison circulating in the blood and are not to be regarded as the result of the direct propagation of the disease through the Eustachian tube. DENKER.

258. The author reports on the examination of a case of deaf-mutism and on one of marked deafness, both of which were carefully observed during life. In the deaf-mute, a boy of thirteen, who succumbed to pulmonary tuberculosis, microscopical examination revealed no changes in the internal ear. A decided thickening of the lining membrane was present. The stapes was adherent to the niche of the oval window and to the Fallopian canal. The oval window was closed by a bony structure and the bone over the entire inner tympanic wall was thickened. These changes are all to be regarded as evidence of previous middle-ear suppuration. Functional examination showed complete deafness for voice, watch, and tuning-forks. If central disease of the auditory nerve can be excluded,—the brain showed no macroscopical changes,—this case shows that the bony occlusion of the round window and the fibrous anchylosis of the stapes are to be regarded as the cause of deafness.

In the second case, the niche of the round window was completely occluded by bone formation on the right side and partly so on the left. The niche of the oval window was not changed on the right side, but on the left was contracted by a hyperostosis of the posterior arm and the stapes was anchylosed to the bony wall. The mucous membrane of both sides was very much thickened. On the left, chronic purulent otitis media was present. There were no changes in the inner ear. Whispered voice was

heard, right, 15 *cm*, ordinary voice, 1.20 *m*; left, whisper 0, ordinary voice 3 *cm*, as well with the ear closed.

Both cases showed that the obliteration of the windows causes a decided deafness. That this, in bilateral cases, is sufficient to produce deaf-mutism appears doubtful to the author, because it is at variance with experience with children with congenital bilateral bony atresia of the auditory canal where there probably is no disturbance in the windows, since these children do not become deaf-mutes but learn to speak in the ordinary way.

DENKER.

b.—METHODS OF EXAMINATION AND TREATMENT.

259. **Koenig.** A new method of rendering direct massage to the ossicles by means of Lucae's pressure probe, less painful and more efficacious. *Arch. internat. d'otolog.*, vol. xiv., No. 5.

260. **Urbantschitsch.** On methodical hearing exercise. *Deutsche Klinik*, 1901.

259. The tip of Lucae's probe, which is supposed to be applied to the short process, is filled with paraffin, thus avoiding excoriations which are frequently caused by irritation; the process is also less painful. SCHWENDT.

260. The author discusses the applicability and value of methodical hearing exercises and relates a number of cases.

BRÜHL.

EXTERNAL EAR.

261. **Schwidop.** On the treatment of acquired atresia of the auditory canal. *Arch. f. Ohrenheilk.*, vol. liii., p. 41.

262. **Hoelscher.** Two cases of foreign body in the tympanic cavity. *Muenchener medicin. Woch.*, 1901, No. 42.

263. **Soplino Bentzen.** On the improvement of hearing by an artificial drum. *Hospitalstudie*, No. 49, 1901.

261. The author has followed the recommendation of Schwartze to cure cicatricial stenosis of the cartilaginous canal after traumatism by retracting the auricle and correcting the stenosis by plastic operation, and by removing concentric layers of bone of the posterior meatal wall. In spite of this the tendency to become smaller was present in the canal and the author had a rubber obturator fitted exactly into the external auditory canal. This was worn for four years. After that the lumen showed no tendency to closure. DENKER.

262. In both cases the foreign bodies had been forced into the

tympanum by efforts at extraction. They were extracted by detachment of the auricle and removal of the posterior margin of the bony canal. SCHEIBE.

263. The author has endeavored to improve the hearing in seven cases of perforation of the drum membrane by the introduction of a moist cotton pellet. In two cases there was slight improvement in hearing, though perception for bone-conduction was diminished, so that an affection of the perceiving part of the ear seemed likely. In five cases there was decided improvement. The author has observed momentary improvement, and permanent improvement in the case of the patient who had worn the cotton pellet two or three hours a day for six months; the hearing was then much better even without the artificial drum.

JÖRGEN MÖLLER.

MIDDLE EAR.

a.—ACUTE OTITIS MEDIA.

264. **Hasslauer.** The bacteriology of acute otitis media. *Klinische Beiträge*, vol. v., No. 3.

265. **Funke, John.** The bacteriology of otitis media. A summary of recorded observations and a laboratory study of seventy-six cases. *Amer. Medicine*, Nov. 9 and 16, 1901.

266. **Jack, F. L.** The treatment of acute otitis media. *Penn. Med. Journ.*, Oct. 5, 1901.

267. **Waterman, O.** A case of suppurative otitis media following influenza, without involvement of the antrum. Complete lack of all constitutional symptoms of inflammatory disease. Operation. Recovery. *N. Y. Med. News*, Nov. 9, 1901.

268. **Smith, S. McCuen.** Some aural complications of influenza. *Penn. Med. Journ.*, Oct., 1901.

269. **McCaw, J. F.** Tuberculous otitis media, mastoiditis and meningitis in an otherwise healthy adult. Report of a case. *N. Y. Med. News*, Oct. 12, 1901.

270. **Ibid.** Influenza as a causal factor in acute mastoiditis and early treatment. *Amer. Journ. Med. Soc.*, Oct., 1901.

271. **Dench, E. B.** The advisability of early operative intervention in acute mastoiditis. Report of a case. *N. Y. Med. Journ.*, Oct. 19, 1901.

272. **Jansen.** Inflammations of the middle ear. *Deutsche Klinik*, vol. viii., p. 193.

273. **Albersheim.** Contribution to the bacteriology of otitis after measles. *Arch. f. Ohrenheilk.*, vol. liii., p. 89.

274. **Alexander, G.** On the operative treatment for opening the mastoid process, with the Schleich local anæsthetic. *Wiener klin. Woch.*, No. 33, 1901.

275. **Hoelscher.** A simple arrangement to procure satisfactory asepsis in operations on the mastoid and skull. *Arch. f. Ohrenheilk.*, vol. liii., p. 36.

264. The author has continued with extraordinary industry the work begun by Leutert, and in the first fifty pages of his treatise has collected and reviewed all that has appeared on the bacteriology of acute genuine and acute secondary otitis media, and in sinus and mastoid complications. A report of 82 personally observed cases follows. These were examined microscopically, by culture, and by animal experimentation. Of the 63 primary otitides, 42 were examined immediately after paracentesis, and 19 after spontaneous perforation. In both groups the diplococcus of pneumonia was found most frequently, next the staphylococcus. Five cases of the first group proved to be sterile, 5 showed streptococci. In the second group the latter were not found at all, and in two cases the bacillus pyocyaneus was present. In the 19 secondary cases, 7 were secondary to influenza but after paracentesis a variety of bacteria were found. The same inconsistency was present in the spontaneous perforations. Consequently it seems that grouping of the otitides from a purely bacteriological standpoint is not a practical thing as a number of varieties are frequently found together.

Finally the author has made some experiments regarding the sterility of the normal middle ear and found 21 ears free from germs, but in 23 there were various pathological organisms present. The bodies were generally examined about thirty-eight hours post mortem. ZIMMERMANN.

265. The various channels through which the middle ear may be infected are, through the blood, through the Eustachian tube, through the tympanic membrane, through the petrosquamous fissure and others, but the most important is by the Eustachian tube. There is no specific germ of otitis media nor is it invariably monomicrobic. The organisms found in their order of frequency, are: Pneumococcus, streptococcus, pyogenic staphylococci, Friedländer's bacillus; and the bacillus of diphtheria is more commonly present than is usually believed. The streptococcus infection is graver and persists longer than the pure pneumococcus infection, but both are usually supplanted by the staphylococci. There is a pure pneumobacillary otitis which is quickly converted into a mixed infection and its gravity depends on the character of the secondary infection. Chronic suppurative otitis is always polymicrobic, and while anaërobic organisms may

play an important part in the pathogenesis of this disease, their constant presence has not been established. Fœtor is due to the bacillus pyogenes fœtidus without anaërobic organisms. Otitic inflammations present different bacteriological conditions in different localities.

In primary tuberculous otitis it is almost impossible to demonstrate the presence of the bacillus in the discharge. Where the disease is suspected it should be looked for in the tissues removed by the curette. An extensive bibliography concludes the subject.

CLEMENS.

266. Particular reference is made in this paper to two stages of acute middle-ear inflammation. First, where there is a hemorrhagic or congested condition with slight, if any, bulging of the drum. Second, where there is a collection of fluid in the middle ear with bulging of the drum. The treatment advised in the first stage is the early use of the Politzer bag most gently performed without producing any increase of the pain. Dry heat is preferred to moist heat and the poultice is unqualifiedly condemned. In the second stage paracentesis of the drum is advised for large or small collections of fluid within the tympanum, whether the drum is bulging or not.

In otitis media serosa or mucosa, the author is partial to early incision of the drum membrane and an expulsion of the fluid contents by Politzerization. Inflation should be continued at intervals until the hearing is restored. CLEMENS.

267. This case is unique because the entire mastoid process was destroyed, while the antrum and the bone surrounding it were absolutely free from all evidences of disease. During the course of the inflammation there was a complete lack of constitutional symptoms. The case recovered, and the hearing, which was practically lost at the time of the operation, finally returned to the normal standard. CLEMENS.

268. Hemorrhagic otitis is considered to be the distinguishing feature of influenza otitis, but while it may not be wholly pathognomonic, hemorrhages do occur from the membrana tympani, auditory canal, upper and lower respiratory regions, the gastro-intestinal tract, and possibly other internal organs. The inflammatory action is intense, rapid, and virulent, manifesting itself in the well known clinical picture. Bacteriological examinations of all the aural discharges are urged since information of vital import is often disclosed.

Out of twenty-three cases seen by the writer, nine were of the distinct hemorrhagic type. In fourteen of the cases where the membrana tympani ruptured spontaneously, the pain, mastoid symptoms, and fever continued from twenty-four to sixty hours after an apparent free drainage had been established. In six of the cases the membrane was freely incised and in each the pain and other symptoms were promptly relieved.

The chief object in treating these cases is to rid the ear as far as possible of the bacteria and to inhibit their further development by destroying the pabulum and by keeping the propagatory surfaces dry. CLEMENS.

269. Patient, male, forty-five years of age, with an excellent family history, had, without apparent cause, a slight discharge from the left ear accompanied with a slight degree of pain. Recurrent attacks of earache, mastoid pain and tenderness occurred from time to time after this, which were generally relieved by a copious discharge of pus. Constant headache, loss of appetite, irregular temperature, gradual exhaustion, and a drowsy condition, which later changed to a deep stupor, soon followed. Examination showed the case to be much emaciated, face ashy color, pupils equally contracted, but no paralyses; the tympanum was filled with granulation tissue and pus; bulging of the posterior upper wall of the canal, and only the head of the malleus remained. Mastoidectomy was performed, at which typical miliary tubercles were found everywhere, associated with much loss of tissue. The autopsy failed to demonstrate the presence of tubercle in the lungs, spleen, kidneys, or mesenteric glands. No examination of the head was permitted, but scrapings from the middle ear and mastoid showed an abundance of tubercle bacilli present.

The interesting question arises, Was this a case of secondary tuberculosis in which the primary focus was overlooked, or a primary tuberculosis of the tympanum and mastoid with subsequent pyogenic infection? CLEMENS.

270. MCCAW thinks that mastoiditis following epidemics of influenza is consequent upon tympanic infection and is therefore a tympano-mastoiditis. Two varieties are recognized and described: The middle-ear inflammation in the first form is apt to develop during convalescence or immediately following the grippal attack, with slowly increasing pain and slight congestion of the drum without bulging. In from twelve to twenty-four hours the symptoms increase in severity, with tenderness of the mastoid and

bulging of the membrana flaccida. Paracentesis affords no relief and the rapid formation of pus is astounding. The second form occurs more frequently during the attack of influenza with sudden pain, hemorrhagic discharge, and mastoid tenderness. The clinical picture is similar to that of otitis hæmorrhagica externa, and impresses the writer with being a more severe condition than the former one, yet it yields more readily to treatment. Infection spreads rapidly, is usually virulent, and produces more cases of acute mastoiditis than scarlet fever, measles, or diphtheria. As an explanation for the development of these varieties of inflammation, he thinks that Perez's experiments with Pfeiffer's bacillus suggest that it does not cause an infection, but an intoxication, its pathogenicity being due to a toxin.

Treatment of the suppurative form is early and free paracentesis, warm douching every two hours, free catharsis, and if no relief occurs in thirty-six to forty-eight hours surgical interference should be employed. Treatment in the hemorrhagic form is rest, free catharsis, leeching in front of the tragus and over mastoid, and hot douching every two hours. In the writer's experience only about 5 % in this class go on to suppuration requiring ultimate operation. CLEMENS.

271. DENCH reports a unique case from which he draws the lesson that early operation on the mastoid is both justifiable and advisable. CLEMENS.

272. Acute middle-ear suppuration and inflammation, catarrh of the Eustachian tube, exudative middle-ear catarrh, and chronic middle-ear suppuration are treated in order. The monograph shows a wide personal experience and the author gives an excellent survey of the subject and its present clinical significance. ZIMMERMANN.

273. This is a report of the bacteriological examination of the discharge in five cases of otitis after measles. The streptococcus was found once, the staphylococcus albus in pure culture once. A bacillus found together with the streptococcus could not be cultivated, and a bacillus found associated with the staphylococcus was demonstrated by culture. It was a small bacterium with rounded ends which could not be classified amongst the groups described by Migula. DENKER.

274. The author has employed Schleich's local anæsthetic in eleven cases at Politzer's clinic, and thinks that in suitable cases

it can replace the ordinary methods of anæsthesia. 35–70 *ccm* of Schleich solution No. 1 were used. Complete composure and patience on the part of the patient were essential.

BRÜHL.

275. The author recommends the use of two square towels, of which one has a central slit 125 *cm.* long, while the other and smaller one has an elliptical opening which exactly embraces the field of operation. Both towels are placed so that the head, chest, and arms are covered. DENKER.

b.—CHRONIC PURULENT OTITIS.

276. **Hellat.** Chronic purulent otitis and its treatment. *Wratsch.*, 1901, No. 37.

277. **Cohn, Felix** (N. Y.). Experiences with the radical operation in acute and chronic suppuration. *Arch. f. Ohrenheilk.*, vol. liii., p. 100.

278. **Matte.** Attempts to secure adhesion of the drum membrane to the head of the stapes after operative treatment in chronic middle-ear suppuration. *Arch. f. Ohrenheilk.*, vol. liii., p. 96.

276. According to the author, chronic otorrhœa in Russia runs a much milder course than is observed in Western Europe, and specially in Germany. Cholesteatomata are rarely observed. In the course of an experience with aural diseases of eleven years the author has only observed two cases of the latter. He thinks the general cause of this is climatic. Perforations of Schrapnell's membrane also seem to be rare in Russia. Chronic exudates in the middle ear are scarce. The views of the author on the treatment of chronic otorrhœa and the radical operation furnish nothing new. SACHER.

277. The author believes that in those cases of acute middle-ear suppuration which are not healed by the ordinary Schwartze operation, especially those where there is caries of the walls of the aditus and of the ossicles, a radical operation is indicated. (Most operating otologists have probably had the same experience.—REVIEWER.) In a radical operation which became necessary two years after a simple mastoid operation, COHN observed complete bony regeneration of the wall of the sigmoid sulcus which had been removed during the first operation. To the Reviewer, the author's duration of healing, four to eight months, after radical operation, seems to be too long. DENKER.

278. In cases where the malleus and incus have been removed the author recommends a perforation of the drum membrane with

the attempt to procure its adhesion to the head of the stapes; of course in cases where the stapes is not anchylosed. He thinks that thereby the functional result is decidedly better.

DENKER.

c. — CEREBRAL COMPLICATIONS OF CHRONIC PURULENT OTITIS.

279. **Hansen.** On the condition of the eye-grounds in intracranial disease of otitic origin, based on observations in the clinic at Halle since 1892. *Arch. f. Ohrenheilk.*, vol. liii., p. 196.

280. **Schencke** and **Streit.** Several cases of intracranial complications of acute and chronic aural suppuration. *Arch. f. Ohrenheilk.*, vol. liii., p. 117.

281. **Hoelscher.** A case of healed abscess in the temporal lobe after chronic otitis media. *Münch. med. Wochenschr.*, 1901, No. 40.

282. **Buys.** A case of brain abscess of otitic origin, with mastoiditis and perisinuous abscess. *Jour. méd. de Bruxelles*, 1901, 46.

283. **Poper.** A case of abscess of the temporal lobe. *Wojenno Medicinski Shurnal*, Nov., 1901.

284. **Bloch, F.** Three cases of otitic septic sinus thrombosis healed by Zaufal's operation. *Prager med. Wochenschr.*, 1901, Nos. 20, 21.

285. **Schultze.** Several cases of otitic pyæmia healed without operation. *Arch. f. Ohrenheilk.*, vol. liii., p. 297.

286. **Grunert.** The operative treatment of otitic sinus thrombosis, especially with regard to the operative exposure of the jugular bulb. *Arch. f. Ohrenheilk.*, vol. liii., p. 286.

287. **Rabzow.** Complications of purulent otitis. *Medicinskoje Oboserije*, Oct., 1901.

279. The author has compiled the experience gained in the last nine years in Halle on the condition of the eye-grounds in otitic intracranial complications.

In all there were 100 cases which he divided into eight groups according to the nature of the intracranial disease. Four cases, however, had to be brought into two subdivisions because the ocular changes were caused by two independent intracranial affections which were also observed at a different period. Four cases of tubercular meningitis, 1 case of internal hydrocephalus, cerebellar tumor, chronic pachymeningitis and leptomeningitis were excluded. In the remaining 97 cases the ocular fundus was found normal in 52. Vascular changes of the papilla (hyperæmia) were present in 19; optic neuritis in 23; and in only 3 was a true choked disc present.

Amongst 11 cases of extradural abscess a slight alteration in the appearance of the disc was discovered in 1 and optic neuritis in another. In 14 cases of uncomplicated meningitis slight alterations were present in 4, optic neuritis in 3, choked disc in 1; while

of 16 cases of meningitis complicated with brain abscess, extradural abscess and sinus thrombosis presented anomalies of the eye-ground in 7, slight changes in 3, and optic neuritis in 4. In 8 cases of otorrhœa cerebral symptoms were present in 3, optic neuritis in 4. Among 8 cases of sinus thrombosis, in 1 there were slight changes, in another optic neuritis, and choked disc in still another. In the 21 cases of complicated sinus thrombosis, vascular changes were present in 5, optic neuritis in 4, choked disc in 1. The 12 cases of cerebral abscess presented slight changes of the optic nerve in 2, optic neuritis in 4; while among the 7 cases of cerebellar abscess optic neuritis was only observed twice.

Changes in the eye-grounds may be present in any intracranial complication. They are most frequently present in those cases where the symptoms point to hyperæmia of the meninges and cerebral œdema (serous meningitis), most rarely in intradural abscess.

Opposed to the view that changes in the disc occur more frequently in cerebellar than in cerebral tumors, 50 % of the cerebral abscesses were accompanied with intraocular changes, while only 29 % of the cerebellar showed an abnormal ophthalmoscopic picture. According to Macewen and Koerner, the changes in the optic disc are always bilateral. The author found both eyes affected in 87.5 % of his cases of brain abscess, and in 12.5 % the eye of the same side alone was affected. (In a case of otitic abscess of the temporal lobe which the Reviewer has recently published only one eye was affected.)

The statement that sight is not affected in cases of fundus change does not agree with the observations of the Reviewer, as he has observed a case of multiple cerebellar abscess where there was distinct diminution of sight in the eye on the same side. In this case a very pronounced choked disc was seen which, according to the author, is very seldom observed in brain abscess.

Regarding the pathogenesis of the ophthalmoscopic changes, the author is inclined to consider one-sided interference with the current in the large sinuses of the brain as a cause for changes in the disc, but this does not satisfactorily explain all cases. In this case we might fall back upon the Leber-Deutschmann theory that the inflammatory substances can gain access to the intervaginal spaces of the optic nerve and thus cause optic neuritis.

DENKER.

280. SCHENCKE reports on 9 cases of sinus thrombosis, 1 case

of otitic meningitis, 1 of epidural abscess secondary to involvement of the saccus endolymphaticus, 2 cases of abscess of the temporal lobe, of which one was healed and the other succumbed to purulent meningitis. Finally 2 fatal cases are reported where purulent meningitis developed after operation on the ear.

Of the 9 sinus thromboses, 6 followed acute and 3 followed chronic purulent otitis. The internal jugular vein was ligated in every case. In case 5, however, where there was a left-sided sinus thrombosis after acute otitis media, ligation could not be performed, because the internal jugular vein was absent on that side and in its place a thin vein appeared communicating with the temporal vein above. All 9 cases but one recovered.

Two points were especially inquired into in the study of these cases: 1. Osteophlebitic pyæmia. 2. The opening of the sigmoid sinus for diagnostic or therapeutic purposes. The question as to the origin of the otitic pyæmia by direct transmission through the osseous channels in a mastoid process is of less importance since the experience of all operators has shown that this occurs very rarely, if at all.

Cases in which the exposed sinus appeared unchanged, but on incision parietal thrombosis and thrombosis of the jugular bulb, were osteophlebitic pyæmia. Although up to the present time no case of otitic pyæmia from osteophlebitis has been demonstrated beyond question, many observations seem to make it very probable that micro-organisms or toxines may pass from the primary focus in the mastoid process into the circulation without affecting the sigmoid sinus and the jugular bulb. According to the Reviewer this can only be definitely settled when an unquestionable case of osteophlebitic pyæmia has been demonstrated at autopsy and bacteriologically, or when, on the other hand, a number of such cases have proved to be sinus thrombosis at autopsy.

As regards the opening of the sigmoid sinus, the author thinks that the danger of air embolus in a patient lying on his back is not very great and is excluded if the internal jugular be ligated. The cases of artificial sinus thrombosis are carefully reviewed and considered as not proved. The thrombosis may have existed before the injury, and have been latent. The author finally does not think that the possibility of an artificial sinus thrombosis has been sufficiently well established, and he regards the exposure and opening of the normal sinus as without danger.

DENKER.

281. Chronic otorrhœa with polypi and sagging of the posterior canal wall, headache, moderate fever, vomiting, and vertigo. At operation a large cholesteatoma with fistula in the posterior auditory wall was found. Fever continued, headache increased, pulse was retarded, rigidity of neck, constipation. On changing the dressing, pus escaped from the roof of the tympanum. Abscess opened into temporal lobe. This opening was later enlarged on account of symptoms of retention. Cerebral hernia. Recovery. SCHEIBE.

282. This very exhaustively reported case is not without interest. In addition to a perisinuous abscess there was another abscess, not, as would be supposed, in the cerebellum, but in the temporal lobe. Convalescence was interrupted by maniacal derangements, and was unusually prolonged.

ZIMMERMANN.

283. At the autopsy of a patient who had suffered from chronic left-sided otorrhœa, two large superimposed abscesses were found in the temporal lobe. The upper one was encapsulated, the lower not. They occupied the upper half of the lobe, and had destroyed the white and gray substances without producing any focal symptoms. SACHER.

284. BLOCH reports three successful cases of septic sinus thrombosis from Zaufal's clinic, where the internal jugular vein was ligated, and the sinus subsequently resected according to Zaufal's method.

The first case was a girl fifteen years old, with left-sided chronic otorrhœa. Eight days before admission had high fever, vomiting, and epistaxis, followed by severe rigors. The eye-grounds were normal, the left mastoid tender about the emissary. The jugular vein was exposed, doubly ligated, divided, and the middle ear-spaces laid bare. A perisinuous abscess was discovered, and the wall of the sigmoid sinus was thickened and covered with granulations. After incision, a stream of fluid blood appeared. Recovery in seven days.

The second case was a young woman aged twenty, with chronic right-sided otorrhœa, who had suffered from fever, headache, and vomiting for three days. On admission, there was no fever, no rigor, but headache, anorexia, retarded pulse, and optic neuritis. A diagnosis of external purulent pachymeningitis with incipient brain abscess was made. On exposing the middle-ear cavities granulations and pus were found in the tympanum and antrum,

the sinus was displaced forward, its wall diseased to a point 2 *cm* beyond the upper knee and below the bulb. The entire stretch was covered with a purulent greenish fœtid membrane. On palpation instead of pulsation a crepitation was heard. Incision was followed by evacuation of air and a number of broken-down, thrombosed masses. The sinus was firmly closed off above and down. The internal jugular was not thrombosed. It was doubly ligated and divided. Convalescence was prolonged, as on the third day an abscess formed, which opened externally at the site of the jugular wound, at the angle of the right jaw, with fever, rigors, and dysphagia. Recovery after nine weeks.

In the third case, a woman of thirty-six, with right-sided chronic otorrhœa, had repeated abscess of the mastoid which had to be opened. Twelve days prior to admission the patient was again taken ill with pain in the right ear and right temporal region, and four days later two very severe rigors developed. Examination showed cholesteatoma, irregular fever, rapid pulse, normal eye-grounds. It was thought that septic thrombosis was likely to be present and the internal jugular was ligated and divided. On opening the antrum and tympanum cholesteatoma was found present, also a fistulous passage which led to the sinus covered with granulations. An incision through the unusually thickened sinus wall permitted the escape of a slight amount of blood. Recovery seven months after operation with hearing for loud voice at 8 *m*.

The author finally cites Zaufal's opinion that in cases of diagnosticated septic sinus thrombosis the ligation of the jugular vein should precede operation on the temporal bone, while in cases where the sinus disease is discovered during operation, the ligation should take place immediately and the mastoid operation be interrupted. PIFFL.

285. Schultze reported from the ear clinic, in Halle, three cases of otitic pyæmia without operation, which recovered. In the first, a month after the opening of the mastoid process, a severe chill with fever for two days suddenly occurred. The temperature then remained normal. No metastases. Gradual recovery.

In the second case, after acute otitis septic pyæmia developed with septic endocarditis and septic cutaneous abscesses with metastases of the joints. The operation was not undertaken partly on account of the well marked heart condition. After

paracentesis the local inflammatory appearances of the mastoid disappeared and the symptoms of septic disease improved in a short time. The joint affections gradually improved under treatment with salicylate of soda, baths, and massage.

In the third case, fracture of the skull with involvement of the sinus followed injury which led to infected thrombosis and severe empyema, but which recovered without operation.

DENKER.

286. The author recommends operative procedure and exposure of the jugular bulb in those cases in which after jugular ligation and incision of the sinus, high pyæmic fever continues and can only be connected with a possible bulb thrombosis. In two cases the operation was done as follows: Prolongation of the retro-auricular incision downward and exposing the jugular vein at the same time. Complete resection of the tip of the mastoid, blunt dissection till the external margin of the jugular foramen was reached. The soft parts must be strongly retracted forward with a blunt hook to avoid injury to the facial nerve. Then the ridge of bone between the jugular foramen and the deepest part of the wound in the sigmoid sulcus is removed with rongeur forceps. The jugular bulb lies then exposed and can be incised.

DENKER.

287. The author relates eight very instructive case histories of otorrhœa in which sapræmia appeared as a complication. In addition in three there was gangrene of the lungs; in two, vegetative endocarditis; in two sinus thrombosis; in one cerebral abscess. Ulcerative endocarditis was encountered in another, in others secondary fibrinous pleurisy, meningitis, pyo-pneumothorax, and nephritis. The author emphasizes the importance in all septic processes and in all cases of doubtful forms of typhoid fever to search for latent disease of the ear. SACHER.

d.—OTHER MIDDLE-EAR DISEASES.

288. **Katz.** Osseous changes in the temporal bone (chronic vascular ostitis) in dry chronic middle-ear catarrh (sclerosis?), with remarks. *Arch. f. Ohrenheilk.*, vol, liii., p. 68.

289. **Jürgens, Erwin.** A case of partial labyrinth deafness following traumatism. *St. Petersburger medicinische Wochen.*, 1901, 47.

290. **Gellé.** Crossed paralysis of the acoustic nerve. *Arch. internat. d'otologie*, etc., vol. xiv., No. 6.

288. Amongst a number of microscopic specimens showing

old inflammatory osteoporosis, KATZ demonstrated before the Berlin Otological Society the temporal bone of a deaf insane patient; the degree of deafness had not been determined. Though a bony anchylosis of the stapes did not exist, very marked osteoporosis occurred in the labyrinth capsule, in the malleus and incus, in the outer wall of the aditus, and even in parts of the walls of the external auditory canal. In the tympanum the remnants of a previous middle-ear inflammation were present. The author believes that the osseous changes in the so-called sclerosis are always of inflammatory origin and that they are usually secondary to periostitis in the tympanum. Opposed to this is Siebenmann's opinion that the metamorphosis of the bone and disappearance of the cartilage is not an ostitis but a phase of a rare developmental process in the cochlear capsule. Katz shows that the osteoporotic changes begin in the bone through a marked catarrhal inflammation furnishing an exciting cause on a constitutional or dyscrasic condition (rheumato-arthritis, scrofula, syphilis, senile changes of a neuro-paralytic or trophoneurotic character).

Therapeutically Katz believes that from recent pathological findings accepted by most otologists, local treatment produces no change, or at best, only a transitory one in the subjective symptoms. He recommends internal use of arsenic, iron, bromides, and in the rheumatic diathesis, springs, the baths of Wiesbaden and Carlsbad, and early treatment of the nose and naso-pharynx.

DENKER.

289. In a case of traumatic labyrinth lesion the author was able to exactly localize the site of the lesion after examination of the hearing with Bezold's continuous scale.

SACHER.

290. After reviewing the literature of the subject, the author describes nine cases. In all there was hemiplegia, in one deafness of the other side. In four cases there was facial paralysis on the same side as the deafness. In some cases paralysis of the sixth and in one suddenly appearing amaurosis were observed. The cause was always tuberculous or syphilitic. The symptoms over the site of the ear were deafness, otalgia, subjective noises, otorrhœa, and sclerosis. This symptom-complex is sufficient to distinguish the hemiplegias due to cortical lesion or to one in the substance of the pons from the usual hemiplegias.

SCHWENDT.

NOSE AND NASO-PHARYNX.

a.—GENERAL.

291. **Schoenemann.** On the development and growth of the turbinates. 166 pp. *Anatomische Hefte von Merkel u. Bonnet*, vol. xviii., p. 58.

292. **Griffin.** The hemorrhagic diathesis in relation to operations of the nose and throat. *Med. Record*, Dec. 7, 1901.

293. **Fliess.** The close relation of the nose and sexual organs. *Bresgen's Sammlung zwanglosser Abhandlungen.*

291. The author has examined the embryos of rabbits, cats, calves, and man. The views of Legal in regard to the development of the lower turbinates are confirmed, namely, that they result from a prolongation of the epithelial channels, epithelial depressions, and lamellæ from the nasal cavity into the lateral wall. The author shows that for the other turbinates the same method of development must be accepted.

His conclusions are: The turbinal system is the result of fissuring of the lateral nasal wall by communicating epithelial ridges or depressions. A canal is also formed on the median line, Jacobson's organ; the fissures of the lateral nasal wall form a system of communicating ridges between the prominent parts on the wall, which remain and later form the primordial nasal prominences or turbinals and are the middle and baso-turbinals. The fissures are the upper and lower Legal's fissures and the lateral ethmoidal fissure. This simple lateral wall of the nose is complicated by a further development of fissures and channels which start from the main channels. SCHWENDT.

292. GRIFFIN claims that from patients with a hemorrhagic diathesis a history is only obtained after an operation. He quotes five cases of this kind with serious hemorrhages after operations, in the first of which the mother and brother were bleeders, although this as well as the other patients were particularly asked beforehand about hemophilia. M. TOEPLITZ.

293. FLIESS describes the changes in the nose which he has observed in menstruation: tumefaction, cyanotic discoloration, pain, tenderness on probing, tendency to bleed over both lower turbinates and the tuberculum septi. These neuralgic changes of the genital zones cause a nasal dysmenorrhœa in which the pain referred to the back and stomach persists during hemorrhage and disappears on cocainization of these areas in the nose. The back-ache originates from the tuberculum septi, while the stomach-ache

is from the lower turbinals. Cauterization of the genital sites cures the dysmenorrhœa. The processes of labor and abortion may originate these neuralgic changes in the nose. On anæsthesia of the nasal genital zones labor pains are to a certain extent diminished. The author endeavors to explain this, for which his original article must be referred to. BRÜHL.

b.—METHODS OF EXAMINATION AND TREATMENT.

294. **Abeles.** Irrigation of the nose. *Bresgen's Sammlung zwanglosser Abhandlungen*, 1902.

295. **Hamm.** Treatment of chronic dry middle-ear catarrh in the pneumatic cabinet. *Muench. med. Wochenschr.*, 1902, No. 5.

296. **Suchanneck.** Forman and its use. *Fortschritte der Med.*, vol. xx., No. 3.

297. **Seifert.** The employment of forman as a snuff. *Deutsche Aerztezeit.*, 1901, p. 8.

298. **Lubtinski.** On the treatment of the swollen lower turbinal in vasomotor rhinitis. *Berlin klin. Wochenschr.*, 1901, No. 52.

299. **Isatschik.** Turpentine oil as a hæmostatic. *Wojenno Medicinski Shurnal*, October, 1901.

300. **Goodale, J. L.** The correction of old lateral displacements of the nasal bones. *Boston Med. and Surg. Journ.*, Nov. 14, 1901.

301. **Gleitsmann, J. W.** On the use of the A. C. E. mixture in operations for adenoid vegetations. *Med. Record*, Oct. 2, 1901.

302. **Carter, H. W.** An adjustable automatic mouth gag. *Med. Record*, Oct. 10, 1901.

294. Nasal irrigations should only be applied in atrophic rhinitis, tertiary syphilis, and in certain cases of hemorrhage. Otherwise they should be replaced by local treatment and sprays. They are to be deprecated as prophylactic in infectious diseases, after endonasal interventions or as part of the daily toilet.

BRÜHL.

295. HAMM recommends the use of the pneumatic cabinet, because he had been able to achieve improvement in three out of eight cases previously treated without avail. It is well known that improvement takes place in certain catarrhal adhesive processes after the use of the pneumatic cabinet. BRÜHL.

296. Forman was introduced by WEDEKIND. On account of its sensitiveness to water it easily breaks up into its three components, formaldehyde, menthol, and acetic acid. While a slight amount of acetic acid does not irritate the respiratory organs, the vaso-contracting and anæsthetic action of the menthol with the antiseptic action of the formaldehyde can be employed in the form

of inhalations to abort inflammatory processes in the upper air passages. This can be done by the use of a nasal glass furnished by Ligner in Dresden. The simplest method is the inhalation of a lozenge of forman dissolved in warm water. For very busy people it suffices to introduce a piece of forman cotton as a nasal plug. It succeeds nearly always in bringing an acute coryza to a complete stop in the first twenty-four hours. It will be worth while to try this remedy in nervous coryza, hay-fever, and tonsillitis. SCHWENDT.

297. The author has had success in the treatment of incipient coryza, and recommends the use of the remedy, even in the advanced stages, to relieve the symptoms and possibly shorten the course. BRÜHL.

298. This is a new procedure to replace the galvano-caustic on the lower turbinals. It consists in injecting a 10 % solution of zinc chloride with a hypodermic syringe and a long needle which is introduced between the membrane and the bone and passed to the posterior end of the turbinate. This has been given the name of "the sclerogenic" method. MUELLER.

299. In a case of severe epistaxis in a patient suffering from malaria, the hemorrhage was repeatedly controlled by the introduction of a cotton plug soaked in turpentine. The author recalls that Billroth had recommended turpentine as a hæmostatic in 1883. SACHER.

300. With a pair of short-bladed straight scissors the septum is divided by a cut parallel to the external outline of the bridge of the nose and about 1 *cm* below it, into a narrow upper strip and a large inferior portion. The nasal bones are then freed from their lateral attachments to the nasal processes of the maxillary bone on both sides by a small saw, and by one or two blows with a mallet, on the convex side of the displacement, they are loosened from the fronto-nasal articulation. The nasal bones are thus lowered and the upper strip of the septum slides laterally upon the lower. The external splint for holding the parts in position consists of a broad metallic forehead plate, from which a finger-like projection extends downwards, and is adjusted to press upon the nasal bridge by two screws regulating it as in a carpenter's vice. M. TOEPLITZ.

301. GLEITSMANN relates how he operates for adenoids and hypertrophied tonsils under ethyl of bromide radically in one

sitting in the upright position. He has thus performed more than 500 operations, mostly without a mishap. He administers more of the drug than others, and has even reached 40 grammes.

M. TOEPLITZ.

302. CARTER'S mouth gag lies flat against the cheek. The instrument can be adjusted to the individual face by a hinge joint permitting any degree of motion. In order to prevent the hinge from closing up and throwing the gag out of the mouth, a series of nine small cogs, into which a peg on the end of a spring lever would fit, was made upon the outer surface of either joint. The tooth-rests are made automatic for adaptation. The gag is opened and closed by the ratchet and spring attachment.

M. TOEPLITZ.

c.—TUMORS.

303. **Lichwitz.** Enlargement of the root of the nose by polyps in the nasal passages. *Arch. internat. d'otol.*, etc., vol. xiv., No. 6.

304. **Newcomb, Jas. E.** Four cases of tumors. *Med. News*, Oct. 26, 1901.

303. This is the report of a case of multiple myxo-fibromatous polypi recurring after removal, and causing dilatation of the root of the nose. The nasal bones were not pushed apart, but the dilatation took place between the nasal bone on one side and the ascending process of the superior maxilla. Removal of the polypi did not correct the deformity.

It can hardly be believed that the pressure from within caused the bones to spread apart, as the size of the polypoid growth was not sufficient for this. It is more likely that the change was pathological, secondary to a periostitic and osteitic process.

SCHWENDT.

304. Case I. *Osteosarcoma* of inferior turbinate in colored male, æt. forty-one. After removal of intranasal adhesion between right inferior turbinate and septum by the trephine, the subsequently formed mass was a spindle-celled osteosarcoma. Case II. True *papilloma* of nasal septum in male, æt. fifty-five. Case III. *Sarcoma* of branchial cleft in male, æt. sixty-five, the tumor occupying the right side of the pharynx, extending from opposite the last molar tooth upward and inward, to beyond the median line, downward to the floor of mouth, and backward into the pharynx. It was removed by Dr. Weir. Case IV. *Angio-fibroma* of the nose in a male, æt. twenty-one, appeared as nasal

polyp, hanging from left middle turbinate and as a mass in the naso-pharynx, reaching back from the choanæ, blocking only the left. M. TOEPLITZ.

d.—OZÆNA.

305. **Perez. F.** Researches on the bacteriology of ozæna. Buenos Ayres, 1901.

306. **Hopmann.** Anomalies of the naso-pharynx as occurring in two cases of nasal suppuration with so-called reflex neurosis. *Münch. med. Wochenschr.*, 1901, No. 41.

305. The parasitic nature of ozæna is proven. The author, amongst many bacteria, found the cocco-bacillus, the Loewenberg-Abel bacillus, and a somewhat similar organism, which he calls the cocco-bacillus fœtidus ozænæ. It is differentiated by staining and cultural peculiarities, and is probably the cause of the disease, as it has the same specific odor, and in experimentation on rabbits produced the typical atrophy of the nasal membrane. The author has also demonstrated that the disease may be transmitted from dog to man and from man to man. A case is reported of the infection of a two-months-old child from its nurse, who was suffering from ozæna.

The author does not accept the opinion of many writers, that the disease depends on disease of the accessory sinuses. In conclusion, he gives a short résumé of the peculiarities of the cocco-bacillus and the Loewenberg-Abel.

ZIMMERMANN.

306. In both cases nasal suppuration existed in connection with congenital lengthening or diminution of the naso-pharynx. The author speaks of the shortness of the septum in ozæna, and believes it to be the result of the general atrophy of the nasal skeleton. SCHEIBE.

e.—DISEASES OF THE ACCESSORY CAVITIES.

307. **Alsen.** Treatment of chronic empyæma of the maxillary sinus, with description of our method of operating. *Arch. f. Laryngol.*, xii., No. 2.

308. **Baurowicz.** A case of mucocele of the ethmoid labyrinth with changes in the orbit. *Arch. f. Laryngol.*, xii., No. 2.

309. **Luc.** Mucocele of the frontal sinus and antrum of Highmore on the same side, associated with rarifying osseus lesions. *Arch. internat. d'otologie*, etc., vol. xiv., No. 5.

310. **Herzfeld.** Rhinogenic abscess of the frontal lobe of the brain healed by operation. *Berlin. klin. Wochenschr.*, 1901, No. 47.

311. **Mouret.** The relation of the frontal sinus to the ethmoid cells. *Arch. Internat. d'Otologie*, etc., vol. xiv., No. 5.

312. **Loehnberg.** Two cases of foreign bodies in the nasal cavities. *Münch. med. Wochenschr.*, 1901, No. 45.

307. Gerber has modified the procedure of Dessault-Kuester, so that after making a large opening in the maxiliary antrum through the canine fossa he makes another large opening from the middle nasal meatus. The cavity is filled with iodoform gauze, and the oral wound is closed with sutures. Drainage occurs through the nasal opening. At first the wound is cleansed and the iodoform gauze introduced daily. After fourteen days the drainage is discontinued, and after irrigation a powder is insufflated. Eleven case histories are reported. The author thinks this treatment more rapid and convenient than any previously described method.

The Reviewer is not convinced of the advantage of this method, as the healing and epidermization of the wound cavity are not accurately followed in the after-treatment.

ZARNIKO.

308. A woman of thirty-two presented a tumor projecting from the anterior part of the right middle turbinal into the orbit, about the size of a bean, and dislocating the eyeball downward and outward. The cavity was accidentally opened in probing and a grayish liquid evacuated. The wound healed primarily. The author thinks that this was a case of osseous cyst filled with mucus.

ZARNIKO.

309. The author has observed a case where there was a swelling of the forehead and infraorbital region with displacement of the eyeball. The pressure and elastic resistance felt as if the tumor were a cartilaginous, fibrous mass. Transillumination revealed the opacity on this side. After operation according to Ogston-Luc had been performed a pale yellow tenacious fluid escaped from the frontal sinus. The maxillary antrum was treated according to the Caldwell-Luc method. Recovery took place in eleven days. The cause of the mucocele could not be discovered.

SCHWENDT.

310. In this case a left-sided and epidural abscess with abscess of the frontal lobe followed acute inflammation of the frontal sinus with retarded pulse as the only objective symptom. In addition there was high fever, with an extremely marked sense of pressure beyond the boundaries of the frontal sinus. Complete

cure in five weeks. Bacteriological examination of the brain abscess revealed the pneumococcus. MUELLER.

311. The frontal sinus is embryologically an ethmoidal cell, but it is not always developed from the same ethmoidal cell. Either of the fronto-ethmoidal cells may develop backward as an accessory frontal sinus, hence the question of securing radical healing after operation in all cases. In the ethmoidal part of the frontal sinus there are the so-called bullæ, namely, the anterior, posterior, external, and internal bullæ. On sagittal section the bone forms the so-called cranio-orbital or cerebro-orbital angle at the place where the lower and orbital parts meet. The relation of the posterior bullæ to this angle is especially important. If the posterior bulla is extensive its extension takes place along the cranio-orbital angle. In other words, suppuration of the frontal sinus is only a subdivision of ethmoiditis. To cure it the frontal bullæ cells and the anterior ethmoid cells must be widely opened. In so doing arterial hemorrhage from the anterior ethmoidal artery may occur; it ceases on pressure. SCHWENDT.

312. (1) An iron plate in the ethmoid bone had entered the orbit after the explosion of a gun twenty years before, and had caused polypi.

(2) A piece of felt in the frontal sinus from the blow of a heavy key on the edge of a hat, producing suppuration of this cavity. SCHEIBE.

f. — OTHER DISEASES.

313. **Fink.** A new method of treating hay-fever and its associated conditions. *Deutsche med. Wochenschr.*, 1901, 46.

314. **Heil.** A case of sneezing during pregnancy. *Münch. med. Wochenschr.*, 1901, 44.

315. **Dodin.** A case of traumatic affection of the nose. *Wratsche. Gaseta*, 1901, 46.

316. **Richter.** Operative treatment of anterior and posterior nasal atresia. *Monat. f. Ohrenheilk.*, No. 4, 1901.

313. FINK believes that hay-fever and its allied affections belong in the category of nervous coryza and are secondary to disease of the trigeminus, especially inflammation of its secretory fibres. He believes the great amount of watery fluid frequently evacuated from the nose arises from the accessory cavities, particularly the maxillary antrum. He therefore recommends aristol by insufflation into the antrum of Highmore through the natural

openings, and has observed such good results that he can safely recommend the procedure. NOLTENIUS.

314. After cessation of the menses attacks of sneezing occurred which were repeated during two pregnancies. SCHEIBE.

315. In this case, occurring in a young girl of eighteen, who had received a blow on the nose with a fist, a septal abscess developed with a large perforation in the quadrangular cartilage and slight depression of the nose. At the same time a subperiosteal purulent infiltration occurred in the middle of the hard palate. The author believes the pus found its way through the naso-palatine canals from the septal abscess to the raphe of the hard palate. SACHER.

316. (1) A girl eleven years old, with congenital syphilis, suffered from complete atresia of the left nose which was relieved by incision from above and from below and after forcible dilatation and tamponing for several days.

(2) In a child six weeks old who suffered from attacks of asphyxia owing to right-sided choanal atresia, with interference with nutrition, an opening was made by passing a knife along the septum and floor of the nose. This opening was forcibly dilated with strong forceps. After tamponing for six days an excellent result was obtained as regards breathing and general improvement.

The author is in favor of early operation in these atresias because they are not difficult to manage, on account of their fibro-cartilaginous nature, the hemorrhage is slight, and asymmetry of the bones of the head is prevented. PIFFL.

g.—NASO-PHARYNX.

317. **Brieger** and **Goerke.** On the pathology of the pharyngeal tonsil. *Arch. f. Laryngol.*, 12, 2.

318. **Fischer.** Adenoids as a cause of enuresis. *Ugeskrift for Lager*, 38, 39, 1901.

319. **Lunin.** Hemorrhage after removal of the pharyngeal tonsil. *Wratsch.*, 1901, No. 42.

320. **Cohen, Solis.** Acute œdema of the larynx following the use of adrenalin. *Med. News*, Oct. 5, 1901.

317. (1) BRIEGER on the genesis of hypertrophy of the pharyngeal tonsil.

The author believes that the influence of certain constitutional factors, such as scrofula and lymphatism, on the size of the

tonsil and the development of hypertrophy of the same has not been proven. The clinical picture of hypertrophy is produced by tuberculosis in a similar proportion of cases whether signs of scrofula are present or not. In rare cases hyperplasia of the tonsil may be produced by syphilis.

Hyperplasia of the pharyngeal tonsil occurs as a symptom of a hyperplastic process in the entire lymphatic apparatus. It is not in itself a clinical entity. The tonsils may be enlarged as a result of the increased demands of the follicles to protect the organism just as other lymphatic structures vary in size and number and may increase according to the demands of the body. The pharyngeal tonsil reaches its highest development in that period of life in which protection against bacterial infection is most sought for. The involution of this tonsil, which is clinically regarded as a physiological process, coincides with the lessened importance of this function in the age where the organism has obtained a certain immunity against infectious diseases which are peculiar to childhood. Incomplete involution is usually due to the persistence of certain pathological processes, such as cysts, bursitis.

(2) GOERKE. The recurrence of hyperplasia of the pharyngeal tonsil.

To explain the relapses which occasionally follow operations for adenoids, it is not sufficient to state that it is a case of lymphosarcoma or that it is due to tuberculosis or other general dyscrasia, such as pseudo-leukæmia, lymphatic constitution, etc., nor to suppose that the operation was imperfectly performed. In order to investigate the true cause the author has made a careful histological examination of the cases he has observed clinically and concludes that in all cases the regeneration takes place from remnants which are left. Whether this is sufficient to produce a new hyperplasia or not depends on whether the same factors—the original causes of the hyperplasia—are again active and lead to increased production of lymphocytes. The author thinks that relapses are more frequent than is commonly supposed and oftener after acute infectious diseases. ZARNIKO.

318. The author has examined a great number of cases and confirms the opinion of some on the partial dependence of enuresis on the presence of adenoids. 716 patients were examined, 106 of whom suffered from enuresis. In 71 cases it was possible to watch the result. Of these 43 were cured, 23 permanently improved, 5 unchanged. Of these, 3 were imbecile children and 2 suffered

from chronic hypertrophic rhinitis. The enuresis is caused by nasal stenosis. It is made worse by acute catarrh, and is also worse in winter than in summer.

In 4 of the cases the enuresis returned with the recurrence of the adenoids. They were cured after a second operation. One case is especially interesting, that of a boy who had never suffered from enuresis until after an adenoid mass had been removed, when he suffered of a decided nasal stenosis through swelling of the mucous membrane. When the nasal respiration became normal the enuresis disappeared. JÖRGEN MÖLLER.

319. The author reports five cases of more or less severe hemorrhage after removal of adenoid vegetations. The chief causes were hæmophilia, anæmia, cardiac disease, prominent vertebræ, injury to the mucous membrane, bony protuberances from the posterior edge of the septum, and vascular anomalies in the epipharynx. Operations during menstruation or acute catarrhs of the upper respiratory passages favor the occurrence of hemorrhage. The author has used with benefit ferropyrine (5 %), warm gelatine solution, and packing. SACHER.

320. The patient, a clergyman, who had been using for his hoarseness and asthma suprarenal extract in glycerine and water, with good result, experienced from an overdose of adrenalin in chloretone an œdema of the uvula and epiglottis, which spontaneously subsided in a few hours. M. TOEPLITZ.

h.— PALATE AND BUCCAL CAVITY.

321. **Hopkins, F. E.** Malignant disease of the tonsil. *Boston Med. and Surg. Journ.*, Oct. 17, 1901.

322. **Griffin, E. H.** Mycosis of the tonsil and base of the tongue. *N. Y. Med. Journ.*, Dec. 14, 1901.

323. **Floersheim, S.** Acute amygdalitis. *N. Y. Med. Journ.*, Oct. 5, 1901.

324. **Rhodes, J. E.** Chancre of tonsil. *Am. Med.*, Dec. 14, 1901.

325. **Getchell, A. C.** Dangerous bleeding after removal of enlarged tonsil and adenoids. *Journ. Am. Med. Assn.*, Oct. 5, 1901.

326. **Loewy.** A case of pharyngeal tuberculosis. *Monat. f. Ohrenheilk.*, 1901, No. v.

327. **Cordes.** Histological examination of pharyngitis lateralis, with remarks on the pathology of sebaceous glands. *Arch. f. Laryngol.*, vol. xii., No. 2.

328. **Smirnow.** Actinomycosis of the tongue. *Medicinskoje Obosrenje*, Oct., 1901.

329. **Lunin.** Leukoplakia oris. *St. Peters. Med. Wochen.*, 1901, No. 46.

321. After an extensive discussion of the observation of others, HOPKINS dwells particularly on the difficulty of diagnosis, citing a case of his own, in which it was difficult to differentiate between sarcoma and simple hypertrophy, in a boy, thirteen years old, who had his suppurating cervical glands removed on the right side, while the right tonsil had grown in two months so much as to fill nearly the oro-pharynx. The tonsil was removed with the galvano-cautery snare, but the microscope did not clear up the nature of the growth. In six months the tonsil had returned to its former size and was again removed with the snare. Nine months later a recurrence had taken place, which was said not to have occupied more than six weeks in its growth. The microscope did not show a positively malignant picture. The patient died of a recurrence, three years after the first presentation.

M. TOEPLITZ.

322. In a very extensive case of mycosis of the tonsil, palate, and base of the tongue in a female teacher, æt. twenty-four years, the enormous masses finally yielded after many efforts to treatment by evulsion with subsequent application of chromic acid, smoking of tobacco, and Rp. Tinctura ferri perchloridi 8.0, Glycerini 60.0, Aq. q. s. ad 90.0, MDS: 4 grammes every three hours to be used as a gargle and then to be swallowed. All cases of GRIFFIN were females. He has never seen the fungus upon hypertrophied tonsils, but only on their former locality.

M. TOEPLITZ.

323. FLOERSHEIM has used the tincture of iodine in sixty-eight cases of acute amygdalitis, catarrhal and follicular, and even in phlegmonous and suppurating amygdalitis, by brushing it well over the parts and subsequent gargling with hot water, whereby relief was often given within five minutes, when all other remedies had failed. M. TOEPLITZ.

324. After a synopsis of the literature and the etiology RHODES fully reports three cases of his own observation and one communicated to him by another physician, and he tabulates thirty-one unreported cases, drawing from all the following conclusions: Chancre of tonsil is often unrecognized. Indurated tonsil with superficial ulcer and accompanying enlargement of submaxillary gland render diagnosis probable. The character of the chancre depends upon the original condition of the tonsil. Positive diagnosis is often impossible. The symptoms of syphilis are not

severer than in chancre elsewhere. The disease is contracted by direct contact. M. TOEPLITZ.

325. Within two hours after the radical operation the girl, æt. five years, of frail constitution, had vomitted five times. The pulse had increased in five hours to 192 beats, but improved after injection of salt solution under the scapula and had returned in eight hours to 140. The child finally recovered in a week.
M. TOEPLITZ.

326. A patient, forty-three years old, had suffered for twenty-seven years with tuberculous ulcers on the posterior pharyngeal wall, which healed after two years' treatment with lactic acid, while the pulmonary affection improved. A relapse occurred six years later in which the posterior surface of the soft palate and larynx were involved, but which healed after six months' treatment with lactic acid. Four years later nasal stenosis, anosmia, loss of taste, dyspnœa, and hoarseness set in. These were produced by a double adhesion of the soft palate to the posterior pharyngeal wall and infiltration of the larynx diminishing the size of the glottis. After tracheotomy the lactic acid treatment was renewed and the laryngeal condition improved. The synechiæ in the pharynx were divided and reattachment prevented by the use of a hard rubber bougie maintained by a thread passing through the nose. This prothesis was carried out for four weeks. Nasal respiration, smell, and taste were restored. The larynx was dilated and the tracheotomy wound allowed to close. The patient has since been free from recurrence (two years) and the author believes him cured. PIFFL.

327. Pharyngitis lateralis constitutes a development of a new, small, elongated tonsil. The formation and growth of this tonsil do not follow the increase of lymphatic structures but is due to a new growth of the crypts and lymphatic elements of the entire follicles. The latter originates from the sebaceous gland. Inasmuch as these develop into lymphoblasts an even surface is the starting point of this diffuse lymph tissue and of the follicles.
ZARNIKO.

328. Three forms of actinomycosis of the tongue are usually described: 1. Primary disease, 2. Metastatic abscess, 3. Affections which extend by continuity to the tongue. The patient observed and operated upon by the author belongs to the first group. A woman of sixty years presented on the left half of the

tongue a painless tumor, as hard as cartilage and about the size of a hazel nut. It had grown in a year and was without local symptoms and without influence on the general health. After removal the microscope confirmed the diagnosis. SACHER.

329. This disease may affect the tongue, lips, and mucous membrane of the mouth and has been described according as it appears as a local or a general disease under the names of psoriasis linguæ, ichthyosis, keratosis, and finally leukoplakia oris. The author describes six cases. He has used as remedies balsam of Peru, salicylic acid, and chromic acid, of which the solution of chromic acid, 1:2, alone had any effect. SACHER.

Obituary.

Professor Trautmann died in Berlin on May 4th after a short illness in his sixty-ninth year. He began as a surgeon in the army; after devoting himself to the study of otology in Halle and Breslau, he became connected with Berlin University in 1868. In 1888 he was elected Professor of Otology, and was given in 1893 the direction of the newly organized department for ear diseases in the Charité, which has recently moved into a new and splendidly equipped building.

Trautmann's shorter publications have appeared in the *Archiv f. Ohrenheilkunde.* A number of excellent monographs bespeak his unusual industry. These are: "Anatomical and Clinical Studies on Hyperplasia of the Pharyngeal Tonsils," and "Surgical Anatomy of the Temporal Bone with Special Reference to the Radical Operation." His last publication was an "Outline of Operations on the Ear," which appeared a year ago in the *Bibliothek von Coler.* HARTMANN.

MISCELLANEOUS NOTES.

Dr. SEBILEAU, professeur agrégé in Paris, has been selected to succeed Gouguenheim as director of the ear, nose, and throat department in the Hôpital Lariboisière, and becomes co-editor with Lermoyez of the *Annales des maladies de l'oreille, du larynx, du nez et du pharynx.*

Dr. L. SECRETAN, Professor of Otology in Lausanne, died at the age of fifty years.

The 14th International Medical Congress will be held in Madrid on April 23–30, 1903. The Section on Otology will be under the presidency of Dr. Juan Cisneros.

The 70th Annual Meeting of the British Medical Association will be held at the Owens College, Manchester, on July 29th to August 1st. In the Section on Otology, under the presidency of Dr. W. Milligan, the following subjects have been selected:

(1) "The Aims and Limitations of Intranasal Surgical Procedure in the Treatment of Chronic Non-Suppurative Middle-Ear Disease," by Prof. Grunert, Ghent, Dr. P. McBride, Edinburgh, and Prof. W. Okada, Tokio, Japan.

(2) "The Etiology and Treatment of Ethmoidal and Sphenoidal Suppuration," by Prof. Grünwald, München, and Dr. H. Lambert Lack, London.

(3) "The Indications for and against Ligation of the Internal Jugular Vein in Cases of Otitic Pyosepticæmia," by Prof. Urbantschitsch, Vienna, and Mr. Ballance, F.R.C.S., St. Thomas's Hospital, London.